POPULAR AVIATION

October

25¢

Do not miss the National Air Races and Aeronautical Exposition in Los Angeles, September 8-16
"I've often had to wish my plane over the tree tops."—LINDBERGH.

. . . . YOUR NEXT THOUGHT

When you are forced to dive your ship into the small landing field—your next thought—"How am I going to get out." In out of the way places, the uncharted landing fields—small and difficult—but land you must. Dive your ship into it and then depend on Naturaline* to get you out—you don't have "to wish her over the tree tops" with Naturaline.

With Naturaline you can get an increased R. P. M. of from 50 to 125 at any given throttle. The complete combustion of this super aviation fuel leaves no condensed unburned gases that cause after heating. You'll have a cooler motor and less overhaul cost with Naturaline.

Just any number of pilots today quite properly fuel with Naturaline on their cross country jaunts. It lifts them out of tight places. The added R. P. M. of Naturaline is what does it—surprising even to veterans. "You'd think the ship had high lift wings," said one of them. "Man! how you can nose her up when you've got Naturaline."

*Naturaline is made from natural gasoline and demonstrates a decided superiority in quick starting, fast pick-up, greater speed —20 to 25 percent more power.

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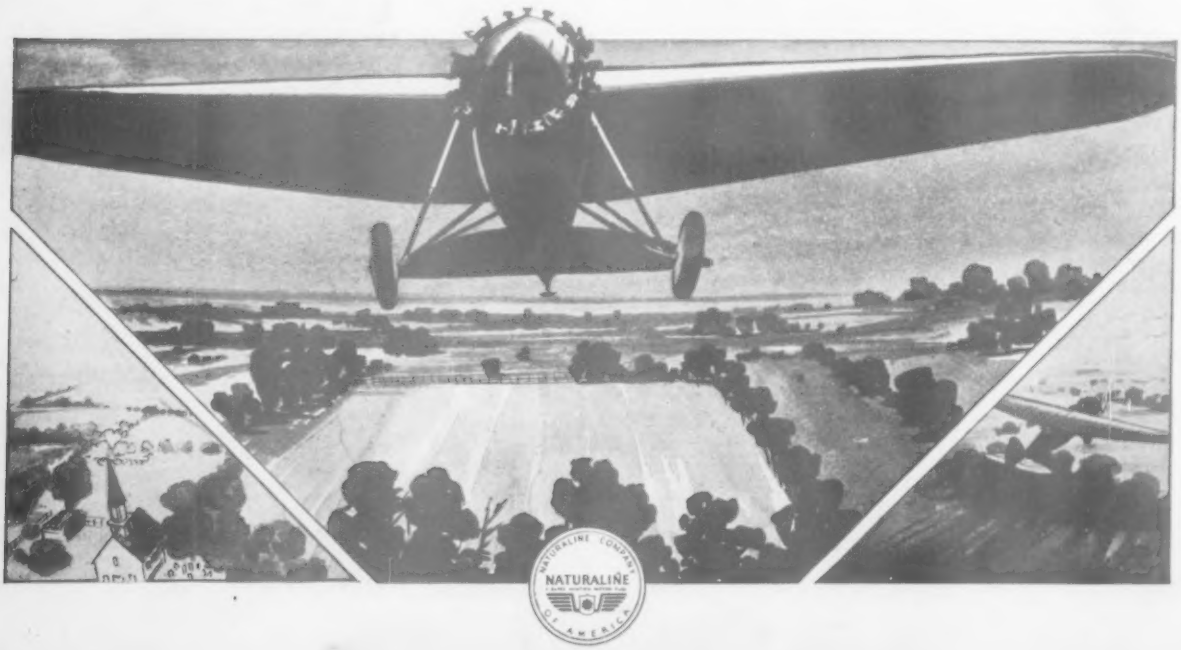

Maj. Gen. John F. O'Ryan, President of the Colonial Western Airways, Inc.

TRANSPORTATION . . . OPERATION

Is there a more exacting test of the capabilities of an airplane than the requirements demanded by regular —safe . . . swift . . . smooth . . . transport operation?

Carrying mail, express and passengers . . . in winter and in summer, in rain, in snow, in fog—over lakes, forests, rivers, and plains, day and night, month after month, maintaining an on-time schedule geared with the wheels of commerce and industry . . . requires an airplane of efficient design and reliable construction.

In fulfilling their appointed tasks, Fairchild Cabin Monoplanes are serving thirty transport operators—covering the continent of North America.★

That Fairchild Monoplanes have earned by proof of *past and present* performance the acknowledged regard of the organizations which employ them in their transport services is reflected by the commendation of Major General John F. O'Ryan, President of the Colonial Western Airways, Incorporated: "Safe . . . Swift . . . Smooth—my verdict on the Fairchild which carried me from Albany to Buffalo on the opening day of the Colonial Western Line. Congratulations to the manufacturer, Sherman M. Fairchild, President." Fairchild Airplane Manufacturing Corporation, 270 West Thirty-eighth Street, New York City.

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UP....

from the top of a mountain

IN countries or localities high above sea level, the performance of an airplane is judged particularly by its ability to take off and climb with a limited ground run.

Where an airdrome or flying field is located at a higher elevation than is usual, an airplane powered by a Fairchild Caminez Engine will take off with less ground run and attain a greater altitude in less time than an airplane powered with a crank engine of the same horsepower.

The reason for the exceptional ability of the Caminez Engine to take off and climb is the result of its low-speed, large-diameter propeller efficiency. The cam principle, four power impulses for each complete revolution of the propeller, achieves low speed propeller efficiency through inherent design without cumbersome reduction gears.

Consequently, a Caminez powered 'plane can take off *from the top of a mountain* with less ground run than is required by many 'planes, powered by the conventional type of aviation motor, to take off at sea level. For the complete story of the Fairchild Caminez Engine, address the Fairchild Caminez Engine Corporation, Farmingdale, Long Island, N.Y.

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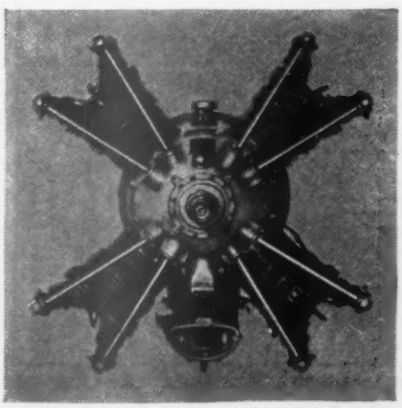
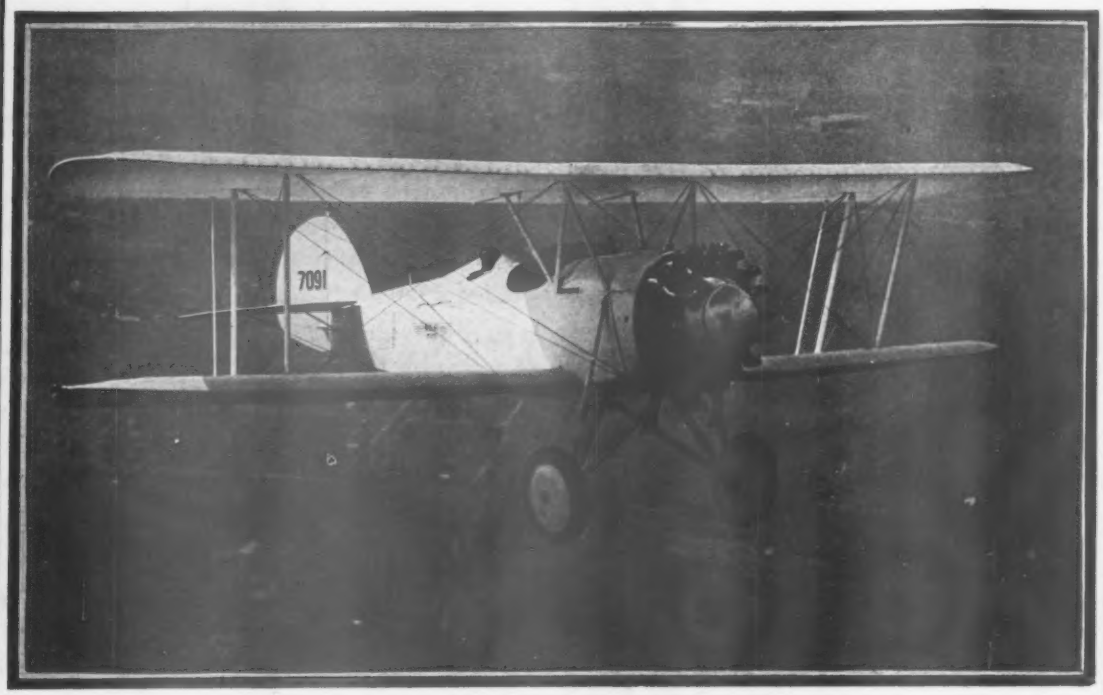


CAMINEZ ENGINES

WACO Performance



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The winning of the National Air Tour was another demonstration of the quality of performance responsible, during the last seven years, for Waco's leading position in the aircraft industry.

Quick take-off
Rapid climb
Fast cruising
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—performance insuring pleasant and profitable flying.

Reasonably prompt deliveries can now be had with OX-5, Ryan-Siemens, Hisso and Wright motors. Type certificates 9, 13, 26, 41, 42.

Write for catalogue

WACO AIRPLANES

The Advance Aircraft Co., Troy, Ohio

Popular Aviation

Published Monthly

Vol. 3, No. 4 — A magazine for everyone interested in aviation progress and development — October, 1928

Arthur T. Goebel

Arthur T. Goebel, winner of last year's Dole Race to Hawaii, has been awarded the Distinguished Flying Cross in recognition of his many achievements in the aeronautical field. His latest is the breaking of the transcontinental non-stop record, when, with Harry J. Tucker, he raced across the United States from west to east in 18 hours and 58 minutes.

Using a Lockheed-Vega monoplane, powered with a Pratt & Whitney Wasp engine, the flight was a demonstration of the excellence of both human effort and mechanical performance. The record may stand for some time—but in Goebel's own words—"Both flights (this and the Dole Race) will seem commonplace within a few years time."

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Get Into Aviation!

SEIZE the biggest thrill ever offered to man—the biggest adventure since time began—smash into Aviation—the game for men with sporting blood! Step into a life of excitement, daring and big money—away from a tame, narrow humdrum existence.

Think what Aviation offers you. Thrills such as you never had before! The praise and plaudits of the multitude. And a chance to get in on the ground floor where rewards will be unlimited!

Amazing Opportunities

Aviation is growing so swiftly that one can hardly keep track of all the astonishing new developments. Air mail routes have just been extended to form a vast aerial network over the entire U. S. Airlines and airplane factories are springing up all over the country. Men like Henry Ford are investing millions in the future of commercial Aviation in America! The possibilities are so tremendous that they stagger imagination!

Everything is set for the greatest boom in history. Big fortunes came out of the automobile industry and out of motion pictures. Big fortunes will also come out of Aviation. The development of Aviation as an industry is bringing with it a call for trained men. The opportunities open cannot be overestimated. Those who qualify quickly should find themselves on the road to undreamed of money—success—popularity—and prominence.

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Get Ready Now for One of these Positions

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- Airplane Repairman
- Airplane Mechanician
- Airplane Inspector
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- Airplane Pilot
- Airplane Instructor
- Airplane Contractor
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- Aerial Advertising

Easy to Get Into Aviation by This Home Study Method

Get into this thrilling business at once while the field is new and uncrowded. Now—by a unique new plan—you can quickly secure at home, during spare time, the preliminary training necessary to get a start in the Aviation Industry. Experts will teach you the secrets—give you the inside facts that are essential to your success. And the study of Aviation by our method is almost as fascinating as the actual work itself. Every lesson is chockful of interest—and so absorbing that you actually forget you are studying. But, best of all are the ultimate rewards you are fitting yourself to gain.

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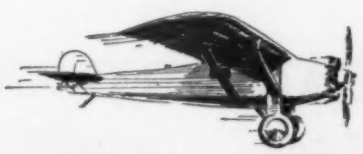
CIVIL aviation, however, has not only an indirect military, but, with its superiority in speed over other means of transport, a direct commercial utility. The nation which first substitutes aircraft for other means of transport will be more than half-way towards the supremacy of the air. Moreover, as the Roman Empire was built upon its roads and as the foundations of the British Empire have hitherto rested upon its shipping, as steam, the cable and wireless have each in turn been harnessed to the work of speeding-up communications, so today, with the opening of a new era in imperial co-operation and consultation, this new means of transport by air, with a speed hitherto undreamed of, must be utilized for communication and commerce between the various portions of Europe.

Military air supremacy can best be assured by the intensive development of industrial air organization for commercial purposes. The conception of civil aviation as the mainstay of our power as a whole is right. Service aviation is bound by technical and financial limits; its scope is confined to the requirements of war. Civil aviation, on the other hand, opens out a prospect of productive expansion.

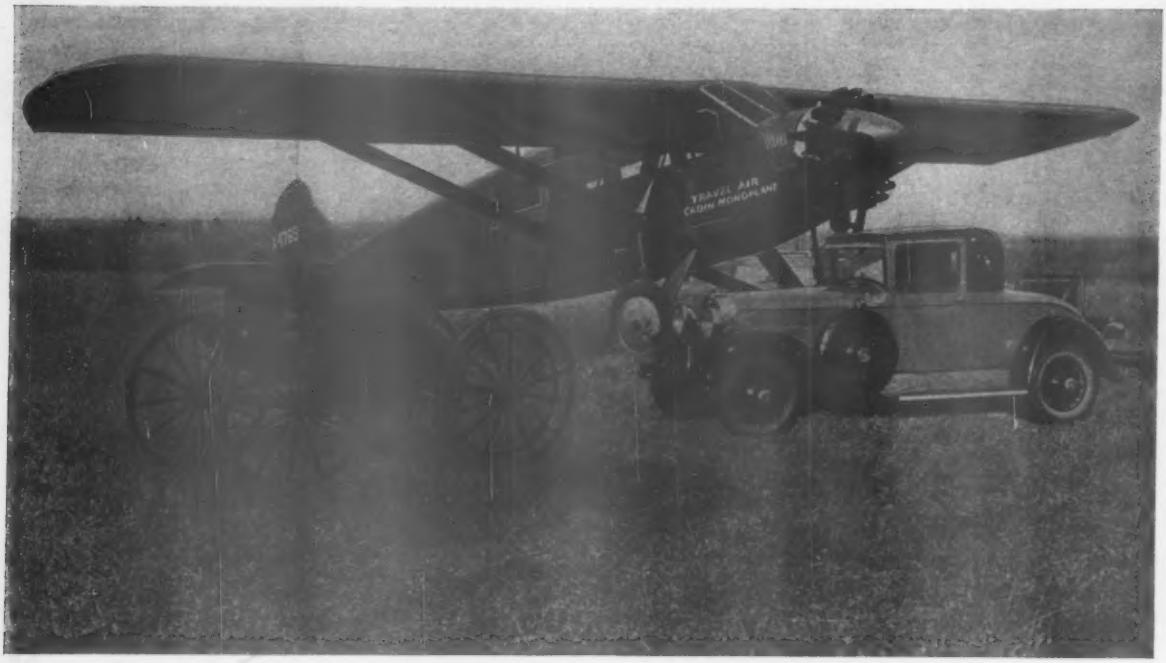
. . . Lastly, we require public support and a spirit of confidence in the air. This can only be secured by increased reliability, reduction of charges and keeping the public informed of the progress made. It is the nature of man to distrust new departures. He disliked the introduction of mechanical devices into the Lancashire weaving mills. He scoffed at the steamship and the railway. Today he is inclined to treat as premature the serious exploitation of the air. In spite of the great decrease in accidents, in spite of the increased comfort of air travel, in spite of increased regularity, the average person is slow to realize that the communication of the busy man of the future will be by air.

. . . In the phase of world commerce of which we are on the threshold, science, brain-power, energy and faith must, and increasingly will, be harnessed to the work of perfecting air communication so that human mobility can be increased, knowledge interchanged, and the fruits of production distributed through the world.

Major-General Sir F. H. Sykes, late chief of the Air Staff, and Controller-General of Civil Aviation in Great Britain, in "Aviation in Peace and War."



THE EVOLUTION OF TRANSPORTATION



The ox cart—old Dobbin—the first one-cylinder automobile—the modern motor car, and now a Travel Air Cabin Monoplane.

At last man has wings—the Air Age is here—the evolution of transportation has brought an era of safety with maximum speed—Boston to San Francisco in 33 hours—private flying clubs everywhere. 7753 miles of charted airways—7974 air mail trips in 1927—24,950 miles flown daily in 1927 with mail—uncounted thousands of miles of private and commercial flights—677 municipal and private airports—665 proposed airports.

Seeing America by air—really "seeing" is now entirely practical—and marvelous. Gaining days over railway—saving 55 minutes in 11 miles—being there at will and leaving at pleasure are every day occurrences. If time is money, there is no surer way of making it than traveling through the air. No wonder executives have taken to the air for big business.

Travel Air, Inc., long recognized as a leader in the manufacture of airplanes and known the world over for the quality of its ships, builds eight types of planes for business and pleasure.

From the manufacture of its first plane the company has steadfastly adhered to exacting and proven standards of construction that each ship delivered would adequately serve the interests of commerce and industry. Intensive and constant study; an extraordinary knowledge and experience in aircraft construction; unexcelled manufacturing facilities; unquestioned financial responsibility—these are the fundamentals upon which every Travel Air is built and upon which every owner and pilot may rely.

The story of Travel Air is told in a beautifully illustrated 24 page book fully describing all models including the new Travel Air Cabin Monoplane—"The Limousine of the Air." The book is free on request. Send for your copy today. Address Department C.

TRAVEL AIR MFG. CO., INC.

The Standard of Aircraft Comparison

WICHITA, KANSAS

How Our Navy Has Taken Wing

Squadron of navy torpedo planes with the Battle Fleet. Some are land and some are sea planes.

YOU may easily visualize a naval aerial combat. First the fleet is separated into enemy and friendly units. As these units draw near scout planes roar off the carrier decks and disappear over the horizon in an endeavor to locate the enemy. When they contact the enemy, pilots report his disposition by radio. On this information the defending commander disposes his forces.

Soon an outlying airplane or surface ship reports a bombing or torpedo attack by the enemy. Forthwith fighting airplanes rise from carrier decks, form up and speed away to intercept the enemy airplanes and shoot them down. This procedure is not at all simple. The air fills with diving, swooping, screaming planes, engaged in the most difficult of maneuvers—fighting to the death above the clouds! Soon these are supported by friendly bombers which attack the enemy fleet.

Meanwhile the United States Battle Fleet approaches the "enemy." The activities of the air fighters must be coordinated to its purpose. The battle lines form up and soon friendly forces harass the enemy with a double offensive—high explosive shells from big guns of the battleships and aerial bombs and torpedoes from bombers and torpedo planes.

Because of the necessity of having aerial eyes and protection from the air, brought about by the advent of long-range firing and the addition to the Battle Fleet of airplane carriers whose decks must be safeguarded against bombs, Uncle Sam has honeycombed the three fleets with sky units. He also has organized the first all-air unit of any navy—a considerable tribute to the efficacy of aircraft! These navy advances have been made possible by the diligent efforts of air-minded navy officers in less than seven years.

During the Battle Fleet's maneuvers in the Pacific this summer the all-air unit was functioning. It was made up of the giant aircraft carrier Saratoga, the older carrier Langley, six destroyers for airplane guards and nearly 200 airplanes, all delivered to the navy since January, 1928. This unit is capable of sending aloft at one time 250 fighting, bombing, scouting and torpedo planes, all of which can return to their seagoing bases.

The members of this unit are capable in any naval maneuvers, strategic or tactical. Strategy, of course, concerns the dispositions and movements to the time of contact with the enemy while tactics has to do with those dispositions and movements in contact and during action. With the fleet at sea equipped with such an air fighting unit, it is apparent that no enemy could establish aircraft bases near United States shores. Hence, an invasion of this country becomes even more remote.

The creation of the new all-air unit climaxes the work of the bureau of aeronautics started in 1921 when Captain H. C. Mustin outlined the navy's policy. This called for development of aircraft capable of operating as component parts of the fighting strength of all vessels of the navy. It looked toward placing of airplanes on battleships, light cruisers, destroyers, submarines and carriers; for fighting planes for combat, observation

A Curtiss Hawk—navy fighter—in the clouds.

planes for reconnaissance and control of gunfire, combined scout-torpedo-bombing planes for offensive work, coastal patrol planes for patrolling sea lanes, scouting against enemy surface vessels and anti-submarine work; and training planes for that purpose.

Six years ago the navy had no planes it could handle aboard shipboard. It was necessary to design new types. As Comdr. E. E. Wilson, aide to Rear Admiral J. M. Reeves, in command of the all-air unit, explained, "these must be strong enough to withstand catapulting, fast enough to compete with land planes in the air and with a landing speed sufficiently slow to permit work in rough water."

What did the navy develop? A plane unsurpassed by any in the world! Lieut. John W. Iseman and Lieut. Louis A. Haase in testing the new Corsair surpassed all test requirements, repeatedly taking off from the water in five seconds. The military performance of this plane is said to be superior to all other planes of its type and, according to official records, its all-around performance at service altitudes even exceeds that of the service type single-place pursuit planes of the army and navy, including the latest navy experimental fighters. The "Corsair" is one of the world's most versatile airplanes. It includes many novel military ideas, including the location of machine guns remote from the cockpit so arranged that the bullets do not fire through the propeller blades.

Interchangeable landing gear of either the land or water type may be fitted to this plane. Arresting gear is provided for landing on the decks of the Saratoga, Lexington or Langley, and it may be catapulted from battleships or cruisers. Radio is provided for observation purposes. This plane is powered by an air-cooled engine.

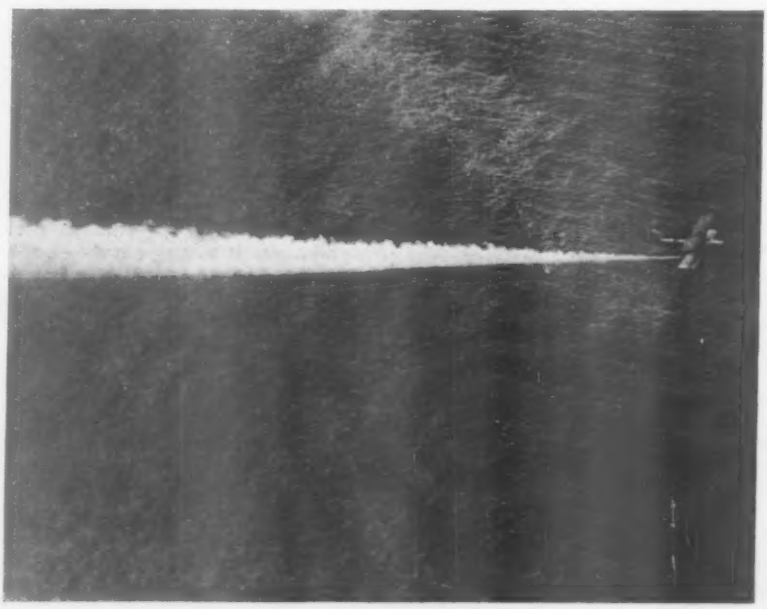
As a matter of practical operation the navy has made phenomenal progress since the war. At that time it possessed some flying boats and some training equipment. Its war activity was limited by inter-allied agreement to use of these two types. Work with specialized types, such as fighters and bombers, was undertaken by the French and English. As a result the United States started at the ground after the war and built up its air force and air service from that point.

Today aeronautics has become an integral part of the fleets. It has become an essential factor in fleet operations. In approximately 6½ years the navy has become supercharged with aviation. It now boasts the best in the world. The navy has on order, in lots of hundreds, service airplanes whose types have broken many world's records. Should war be declared tomorrow, the navy could multiply its aircraft by speeding production.

Although more planes are concentrated in the Aircraft Squadrons, Battle Fleet, based normally at San Diego and San Pedro, than in any other units, all three fleets now carry airplanes for specific purposes. The Battle Fleet utilizes both land and sea planes, while the Scouting Fleet on the Atlantic and the Asiatic Fleet use pontoon-equipped planes only. These fleets have no carriers.

The navy recognizes the importance of aviation to the fleet, both with respect to material and personnel. The U. S. S. Texas, flagship of the United States fleet, carries three planes. Admiral H. M. Wiley also has with him an aviation aide, to advise in technical matters. The

Torpedo plane laying a protective smoke screen for the Battle Fleet.

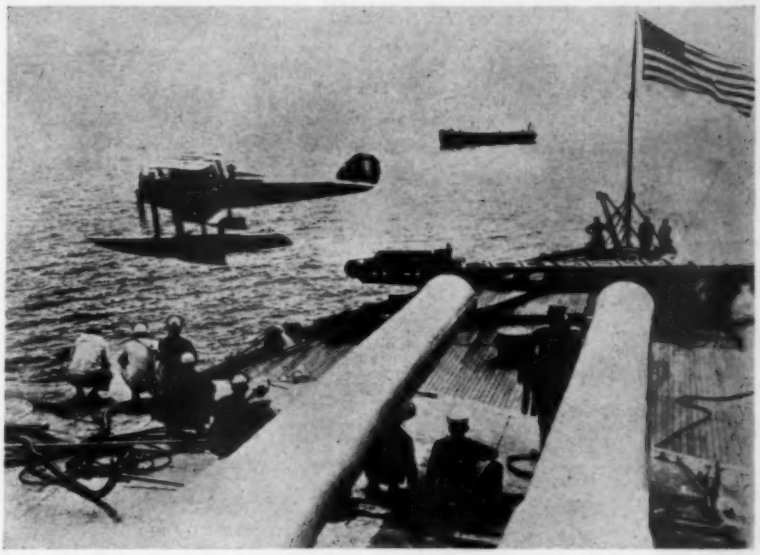


commanders of the individual fleets also have their aviation aides.

The original plan to furnish aircraft to the destroyers has not been carried out yet. Destroyer squadrons have their aerial eyes, however. The cruiser Omaha, in the Battle Fleet, leads the destroyers and furnishes its planes for their use. While the program called for airplanes to be stationed aboard submarines, this phase remains experimental. One disappearing plane was installed on an "S" boat, but the navy does not yet know whether it will establish planes aboard underwater craft.

The Scouting Fleet consists of six battleships in two divisions. Each ship carries two observation and one fighting plane. Each light cruiser in this fleet carries two observation planes. Separate ships in the aircraft squadrons also carry torpedo-bombing planes. The same plan is carried out in the Asiatic Fleet. In each of the three fleets, planes are stationed aboard individual ships, with a separate command of planes in each fleet. Those located with the combat units assist in performing their missions, while auxiliary planes act as an air service, as distinguished from the air force.

All sea-going air units are known as Fleet Air, and are composed of three wings—fighting, observation and torpedo and bombing. The fighting planes are confined to the Battle Fleet's service, because the Scouting and Asiatic Fleets have no carriers from which the fighters may rise. Partly because of the presence of the fighting airplanes, the Aircraft Squadrons, Battle Fleet, form the most formidable air fighting squadrons in the world. They carry on a crowded schedule of practices and each month take part with the fleet in exercises.



Seaplane being catapulated from U. S. S. Maryland.

On one problem, one group of fighting planes act as friendly aircraft, and on the next as "enemy." Thus the air and surface craft have developed almost perfect coordination in tactical maneuvers. Now the Battle Fleet is trained in the use of aircraft for both offensive and defense work and its equipment was perfected during conditions approximating those furnished by war.

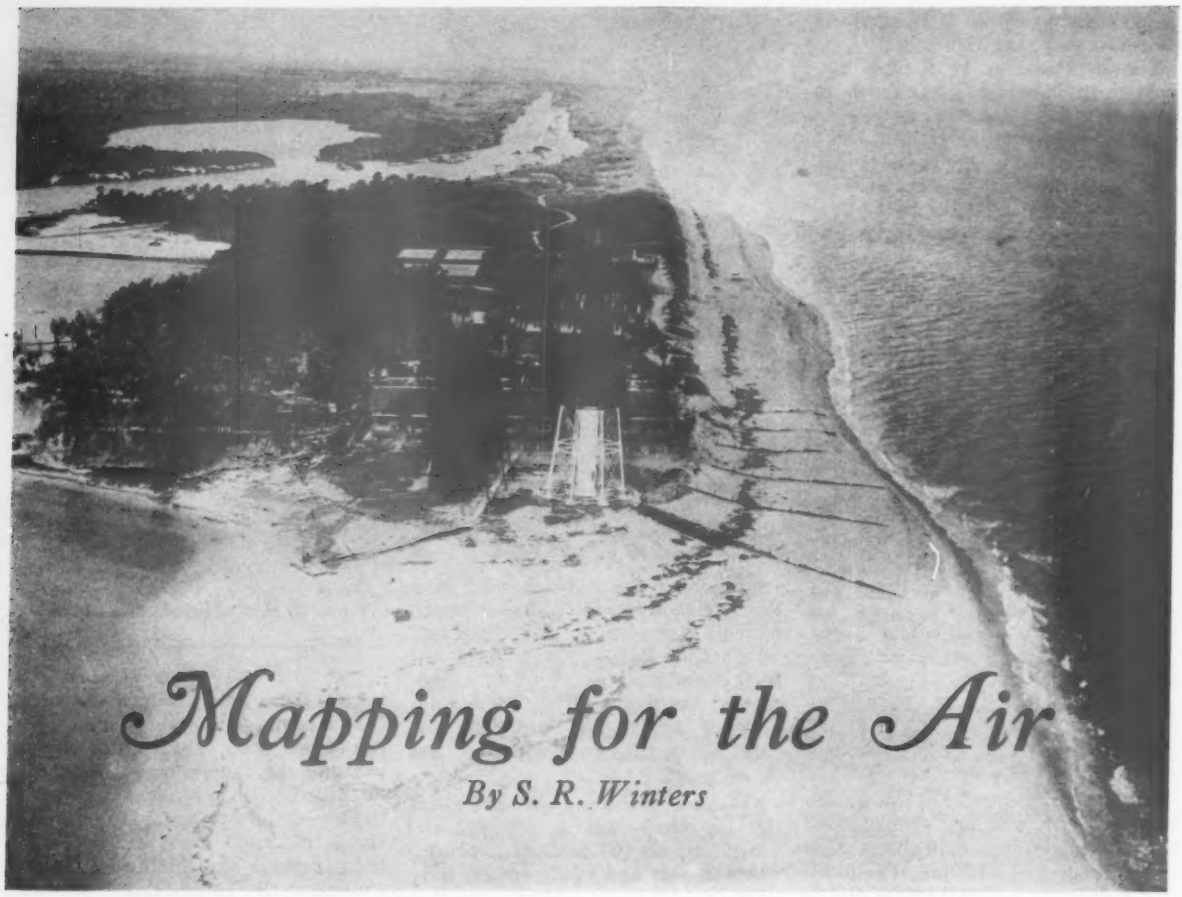
But some means must be provided to keep these planes in the air. There is no Aladdin's lamp to turn the trick. The naval air station on North Island is the repair shop. This island, situated between San Diego bay and the Pacific ocean, has been identified with aviation since Glenn Curtis established an aviation school there in 1910. Many records have been broken and historical flights conducted there since that year.

On the island now are storehouses, shops where Fleet Air equipment is repaired and space for training new officers. Future flyers undergo an indoctrination course. Classes run continuously through the year, 30 members to a class. Every navy academy graduate must take this course during his first year out. He receives 10 hours of dual instruction and an examination for solo, radio, gunnery and bombing. This determines whether he later will become a qualified flyer.

The principal mission of the station has become that of supplying and repairing material for the Fleet Air. Planes are erected and tested and later repaired. Here the commanding officer acts as a landlord for a traveling tenant.

Today the fleets form a gigantic and well-ordered business. Its departments are highly organized, as is necessary to keep its ships moving and its planes in the air. These accomplishments mentioned have been brought about largely by "regular officers," often thought unsympathetic to aviation. As a result the navy has the first "mailed fist of the air," capable of launching an offensive on any ocean in any season.

The North Island Naval Air Station, headquarters of the Aircraft Squadrons, Battle Fleet. Both Army and Navy use this field.



Mapping for the Air

By S. R. Winters

Lighthouse at Hillsboro Inlet, photographed by the Cuban Aerial Survey Unit in 1927.

A PILOT flying from New York City to Havana, Cuba, may be seen guiding his plane with one hand while holding a strip of paper—the length of his arm and the width of two hands—in the other. He is not leisurely reading the newspaper— a futuristic convenience of the pilot—but he is consulting an aviation chart. This is to flying what the "bluebook" is to automobile touring and what the "time table" is to railway travel—and in addition it is an insurance policy when navigating over water!

This aviation chart—partly the result of mapping from seaplanes at an altitude of 10,000 feet—brings into bold relief the "seamarks" along the lanes of coastal aerial navigation. Just as highways, railroads, and cities afford landmarks for flying over land, the lighthouses, beaches, seaplane runways, radio compass and radiotelegraph stations, and fish stakes—all identified on this aviation chart—serve as "seamarks" —if this term is permissible—when navigating over water. This map or chart—taken from the air and for the benefit of airmen—will prevent a recurrence of the experience of the pilot who unavoidably sacrifices his unwieldy folding chart to a merciless propeller.

Lieutenant Eugene F. Burkett, Officer-in-Charge of the Section of Aerial Navigation of the Hydrographic Office, United States Navy Department, relates the following unhappy experience occurring in a seaplane flight between San Diego and Seattle: "After rounding Punta Gorda, one of the pilots turned the controls over to his second pilot, and reached for his chart to estimate his ground speed and drift. It was necessary to refold the chart. Just for a moment, put yourself in his place, and imagine struggling with a chart 33 inches wide and 48 inches long in the open pit of a plane making 85 miles an hour. And, if your imagination fails you, pick out a long straight highway in an open automobile making the same speed.

"After being down for a count of fifteen from a blow which sent his chart to the bilges and required his radio operator in the bow to recover it, the pilot finally came up for air with the chart firmly clutched in both hands. 'I've got it now!' he grimly smiled to his fellow pilot. But his troubles had only begun. He raised himself slightly in his seat to glance astern to determine his drift angle, which is easily done by sighting along lines painted on the trailing edge of the wing toward the last known point of departure.

"He picked up Punta Gorda well astern and was just reading his 10-degree drift angle when his chart—suddenly coming to life like an apparently exhausted fish after a momentary breathing spell—caught the wind in a bellowing hold and snatched itself free, only to be torn to shreds as it passed through the starboard propeller. The mechanic standing up in the after cockpit violently bumped his head on the cowling to let the chart flash past the finish post—winner by a length.

"After such experiences, is there any wonder that pilots at first requested, later insisted, and finally demanded, publication of aviation charts and strip maps of convenient

size and scale for coastal and cross-country flying?"

This question is asked and answered by the Hydrographic Office of the Navy Department. The answer is: Eighteen aviation charts have been published to date—covering seaplane routes between New York City and New Orleans, La.; from Key West, Fla., through Havana, Cuba, to Cape Haitien, Haiti; and from Havana, Cuba, down the East Coast of Central America to the Panama Canal Zone. The charts completed embrace seven naval districts—third, fourth, fifth, sixth, seventh, eighth, and fifteenth.

During the fiscal year of 1928-29, fourteen other aviation charts will be made, these to cover the following routes: From New York City to Eastport, Maine; from San Diego, Calif., to Vancouver, B. C.; and from New Orleans, La., to Puerto Mexico, Mexico. These charts will embrace four naval districts—eighth, eleventh, twelfth, and thirteenth.

Aerial mapping in this, as in other remote inaccessible areas on land and water, has come to the rescue of surveying parties on foot or to ships unable to penetrate out-of-the-way places. Observations of the surveying ships of the Hydrographic Office, for example, have been appreciably simplified by use of photographs taken at an altitude of 10,000 feet. These aerial photographs are employed in plotting the shore lines of inaccessible areas along the coast of Cuba, Venezuela, and the Gulf of Panama. Adventure and romance are interwoven with flying when we consider that some of these areas are uninhabited, and the mapping crew are only transient inhabitants —remaining aloft, at that!

The K-2 camera mounted on a DH plane.

The aerial photographs of lighthouses, seaplane anchorages, and landplane fields, are employed in the making of aviation charts. For example, on one of these strip maps or charts may be found a half dozen lighthouses, including Cape Lookout, Oracoke, Cape Hatteras, Currituck Beach, Cape Henry, and Cape Charles. Reproductions of these airplane photographs appear on the face of the chart, serving as a borderline for an enlarged map of this particular coastal region. Standardized symbols on this map indicate whether these "seamarks" are lighthouses, radio stations, lightships, or lighted beacons.

The reverse side of this "time table" and insurance policy for navigators of the air gives the distance in nautical miles, between certain points along the seaplane route, and an outline of the objects found at the landing field. Take Langley Field, Virginia, for an example: Tide range, 2.2 feet; currents, weak; bottom, mud; beach, at seaplane runway (sunken piling north of runway); repairs, all; refueling at seaplane runway; communications, Army radio, telephone and telegraph; remarks—Beware of fish stakes—Land plane field as indicated. Down at Elizabeth City, North Carolina, we find the following conditions, as outlined on this hand map: Tide range, 2.0 feet, depending on force and direction of wind—northerly winds lower, and southerly winds raise water level—no periodic tides; currents, none; bottom, soft mud; beach, as indicated on chart; repairs, none; refueling, gasoline dock, Texas Oil Co.; communications, telephone and telegraph.

A standard set of symbols, colors and contour lines has been adopted for these aviation charts; these having the approval of the Board of Surveys and maps of the Federal Government, represented by the Departments of Navy, War, and Commerce. A standard scale of 1 to

O-L 8 standard observation plane used on all mapping expeditions.

500,000 and a uniform width of 10½ inches have been adopted in the production of these maps or charts. The overlap between adjacent aviation charts varies according to the contour of the coast line and the limits of the chart—running from 15 to 50 miles. As far as possible, we are told, the charts are laid out so that the terminal point of each would be the logical seaplane anchorages for planes making coastal flights.

"In addition to the safeguards already established and proposed to facilitate aerial navigation, three government departments—Navy, War, and Commerce—have been assigned the duty of making aviation charts and maps," points out Lieutenant Burkett, one of Uncle Sam's official map-makers of the air. "In view of convenience to pilots," he continues, "and the neccessity of avoiding confusion to the air navigator, certain standards have been adopted by those three agencies and are now in use.

"Maps prepared for the use of aviators differ in many particulars from those prepared for other purposes. The best type is one in strip form which provides the pilot or navigator with an instantaneous perspective of the route to be flown over and is free from unnecessary detail. This feature is of tremendous importance to pilots in that it enables them to pick at a glance the distinguishing characteristics of an area with which they are unfamiliar.

"A seaplane pilot, flying from Charleston to Jacksonville, does not care how high the mountains are nor how many high tension transmission lines are located in the country 20 miles away from the coast, although this is most important information for the landplane pilot who is not at all interested in the depth of water at the seaplane anchorages.

"Certain topographic features, such as rivers, lakes, highways, railroads and cities, provide excellent landmarks for navigation, particularly when emphasized by contrasting color combinations, the use of which enables the pilot to obtain immediately information that would require considerable time to secure from other maps.

"Of the methods in common usage by map makers to show elevations, the system of color gradients is most satisfactory in that it provides the pilot with a picture relief of the terrain flown over, enabling him, when caught in bad weather, to navigate through mountain passes or around isolated hills capped with dense fog. Mountain peaks are made more conspicuous by color differentiation, thus providing the airman with dependable landmarks in country which is rough.

"Three planes of the Alaskan Aerial Survey Expedition, returning from Juneau to San Diego last Fall, were able to fly through rain below heavy clouds only because the pilots knew the altitude of the mountain passes through which their course would lead them, and were reasonably certain that the cloud level would be above the passes.

"If lost in rain or fog while driving an automobile, it is comparatively simple to stop and ask the way—but being lost in a plane in mountain passes during similar weather is decidedly a different proposition. The pilot cannot afford to get lost under these circumstances—to do so invites almost certain disaster.

"The fact that the air mail goes through with such remarkable regularity is due in great measure to the fact that each pilot knows every mountain, hill, and valley over which he flies. The purpose of aviation charts and strip maps is to supply at a glance these most essential features which the air-mail pilot has learned by experience.

"The number of colors to be used, however, has been limited to seven for economic reasons, and because the value of more colors does not appear to justify the expense of additional plates required. With a gradient scale of seven colors, varying from green for sea level to the darker shades of brown for highest peaks, the pilot is given information commensurate with the precision of his navigation instruments. Information furnished by several additional color gradients, while desirable, would be of no practical advantage to the navigator and would increase substantially the cost of each map.

"To keep pace with the five-year building program of naval aviation, the Hydrographic Office of the Navy Department has undertaken the publication of aviation charts covering the coasts of the United States, Cuba, Mexico, and Central America.

The lighthouse at St. John's River, taken by the Cuban Aerial Survey Unit—1927.

Realizing that it would take several years to get all the aviation data necessary to publish these charts in complete form, the Hydrographic Office has launched a program calling for the publication, during the present fiscal year, of provisional aviation charts covering the entire coast of the United States and Cuba.

"To facilitate planning of flights, a distance table, a chart index, and seaplane anchorage chartlets are printed on the back of each chart. Suppose a pilot is making a flight from Hampton Roads to Havana. By turning to the back of this chart, he can pick off immediately the numbers of the five charts required for this flight. Then, by referring to the distance table and knowing the cruising range of his plane, he can easily decide upon his intermediate stops. A glance at the seaplane anchorage chartlets will then give the depth of water, tide range, maximum current, character of bottom, refueling facilities, communications, and the most desirable anchorage at each stop. The location of the United States Weather Bureau stations is shown to aid the pilot in obtaining the weather reports essential to safe flying.

"The data included on the back of the chart are primarily for use in planning a flight, while that on the front are necessary during the actual time in the air. After taking off, the pilot has only to glance at the chart to get his magnetic course and distance. If he desires to follow the coast, it is a simple matter to estimate them with a sufficient degree of approximation. Pictures of the most important lighthouses are shown within the border and afford a reliable means of checking position at frequent intervals. The characteristic of each light is also included for night flying. A time-speed-distance table is given as an aid in determining ground speed during the flight. All well-established landing fields, seaplane anchorages, Coast Guard stations, radio and radio-compass stations, and the limits of the naval districts with headquarters of each, are indicated."

It requires no great stretch of imagination to visualize a future time when these aviation maps or charts—outlining "seamarks" on the coastal highways of the air—will reach across the Atlantic Ocean. Then, if the proposed seadromes are established in the middle of the ocean, aerial photographs will indicate the location of these to the trans-Atlantic flyers just as the present charts point out the lighthouses and other markers along our own coasts. Until then, the Hydrographic Office of the Navy Department suggests that commercial aviators obtain the existing 18 aviation charts—available either through the Hydrographic Office and its agents in various cities or through the Bureau of Aeronautics of the United States Department of Commerce.

Photographic party before start for New York.

Giant Aviation Map

THE accompanying photograph shows a giant Rand McNally map of the United States which has recently been erected at Lambert Field (St. Louis Airport). Standing in front of the map (left to right) are Major Albert Bond Lambert, former head of the Lambert Pharmacal Company; Mr. Fred L. McNally of Rand McNally & Company, map publishers; Mr. Harry L. Salisbury, Director of Public Works, City of St. Louis; Douglas K. Condie of the firm of McDonald & Condie, Architects, and H. D. Condie of Condie-Bray Glass & Paint Company.

The map measures 10 ft. 2 in. by 6 ft. 6 in. and is the largest of its kind published. It is covered by a great sheet of plate glass and is mounted in an elaborate specially built shelter.

In the Air on the Ground

Interior of the aeronautical instrument laboratory of the Bureau of Standards.

UNCLE SAM sheds neither his brilliant trousers, swallow tail coat nor six quart beaver when he goes up in the air for he does his flying on the ground.

Paradoxical though this may sound, it is as true as time. Sane and sensible science, the north star of aeronautics, has perfected efficient simulations of sky-high conditions so that aircraft models can be tested on terra firma in wind tunnels and altitude chambers.

Instead of donning clothes which resemble the toggery of deep sea divers, our federal "birdmen" who fly in national laboratories at Washington put on the aprons of chemistry, the "unionalls" of engineering or the rubber gloves of metallurgy in eliminating the err from aeronautical and aerodynamical riddles.

The conquest of the air is impossible "in toto" until the complete mastery of the science of flight is consummated. Science blazes the trail which mechanics follows. Potential improvements in aircraft will swing along hand in hand with developments in scientific research.

For example, how is the noise of the speeding airplane to be muffled? When aircraft in the future rival in number our registration of motor vehicles, skyland and the earth below will reverberate with the clamor of lusty-lunged cloud cruisers unless science finds efficient mufflers.

Should the aerial power plant be concentrated in a few units or distributed in many, and where should they be placed? How can weight per horsepower be reduced without sacrificing reliability or shortening useful life? How can operating costs be curtailed to reasonable amounts? How can lubricating systems be improved to give more dependable winter service?

For many years the Bureau of Standards at our National Capital has assisted both the Army Air Corps, Naval Air Service, as well as commercial concerns in the practical solution of aviational problems. At present, this branch of the Sam family is also engaged in self-planned research. The whole question of the use of light alloys of aluminum for aircraft construction is being studied from A to -izzard. Such technical matters as corrosion, resistance to fatigue and tensile strength are being investigated from the bottom up and from the top down. It is essential that science learn as much about duralumin as it now knows about structural steel.

Logically, it is Government work, this business of finding practical answers to the most knotty inquiries of aeronautics. Unbiased and impartial results from experimentation are thus insured. Furthermore, the Bureau of Standards is the best equipped for such research of any existent American agency.

The matter of accurate aeronautical instruments which guide the pilot in his handling of his "atmosphere limited" is crucial. Seafaring ships never clear from port unless they are equipped with reliable compasses, chronometers, sextants and radio outfits. Ships that cruise the air are even more dependent on their specialized instruments including earth inductor compasses, radio beacons, capacity altimeters and the like. Government experts are doing everything possible to standardize the instruments now in use—and to originate even more efficient equipment for future service.

The tendency of duralumin to corrode, particularly when exposed to salt air has been one of its serious drawbacks so far as airplane construction has been concerned. All this corrosion seems to be of electrolytic origin. This corrosion is not apparent on the surface of the alloy

and can not be detected by ordinary inspection. It weakens the bonds between the crystal grains of the alloy. Two years of careful study by Bureau of Standards' specialists have resulted in the discovery of efficient controls. The duralumin which is quenched in cold instead of warm water in cooling after manufacture is coated with pure aluminum. This paint is resistant to corrosion. Duralumin specimens treated in this manner have been exposed to salt air for one year and have suffered no deterioration whatever from corrosion. Aluminum-painted duralumin is further improved for aircraft construction by being covered with such protective films as varnish or grease.

A new fabric has been developed by the national experimenters which can be used as a substitute for the historic goldbeater's skin employed in lining the gas cells of dirigibles. Goldbeater's skin, as you may know, is obtained from intestines of cattle. It took some 40,000 carloads of cattle to supply the material for the gas cells of the Los Angeles and the ill-fated Shenandoah. One objection to the goldbeater's skin has been its high cost—approximately $10 a square yard. The new waterproof fabric made of cellulose originated by the Bureau of Standards is only one-third as costly. It is efficient, durable and will store the contained hydrogen or helium gases in a satisfactory manner. This new fabric will be used in the production of the two new giant dirigibles which the U. S. Navy plans to build this year at a combined cost of $11,000,000.

The early tests in radiotelephony communication between federal officials at their desks in Washington and aviators flying in planes from 10 to 100 miles distant have been conducted successfully from Washington headquarters. It is not anticipated that two-way telephony between airplanes and ground stations will find immediate widespread use as a result but, in the future Uncle Sam expects to see this new development become popular.

A three engine all metal airplane with a sound-proof cabin was used in the tests. It was equipped with a 100 watt transmitting set and conversations were held with the ground from distances up to 100 miles. Through cooperation with a Washington telephone company, direct connections were made also with the regular telephone exchange. Government experts sat at their office desks and talked with the observer in the moving airplane. One potentiality will be the possibility of passengers in commercial aircraft conversing with friends and relatives in cities over which they fly. As a radio novelty, the first voice received from an airplane in this way was broadcasted in Washington so that thousands of radio fans were thrilled by listening to the recital of events taking place "in the land of the sky."

Other radio aids to air traffic which have been developed include the directive radio beacon and a system of marker beacons. The radio beacon was developed originally by the Bureau of Standards for the War Department and has since been improved. It sends out a directive type of radiation by means of which the pilot can follow a set course. The marker beacons are low-power radio transmitting outfits located on emergency landing fields and serving as milestones to show how far flight has progressed along the designated course. The Department of Commerce in time hopes to broadcast weather information from established ground stations to airplanes in flight and thus to facilitate landings and general navigation.

The radio beacon at College Park, Maryland, used by the Bureau of Standards in aircraft tests.

Interior of one of the testing laboratories of the Bureau of Standards.

Important experiments with triangular and square girders for aircraft have been performed in the Washington test shops during the last year. Certain types of girders hitherto have not been efficient when loaded to full capacity because of the twisting tendency developed in their longitudinal members. By fortifying these members against twist, the strength of the girders has been increased greatly. In some cases, this gain has been as much as 50 per cent without adding to the original weight. Important research has also been conducted to ascertain the strength of tubes of duralumin and alloy steel when used as columns or beams in aircraft building.

Uncle Sam has recently perfected three helium purity indicators for airships in addition to a special device which is qualified to determine helium purity simultaneously at

four different points in the ship. Tests have been made of airplane engines equipped with superchargers installed between the carburetor and the intake manifold and designed for low altitude work. Tests have also been made under ideal supercharging conditions with air supplied to the carburetor at sea-level pressure while the pressure at the exhaust ports is reduced to the standard pressure corresponding to any desired altitude.

The trio of Government wind tunnels in Washington are modern saviors of life and limb. They facilitate the testing of airplane models and parts on the ground. These experimental wind tunnels equipped with large motor driven fans develop miniature storms in which the wind velocities range from 75 to 80 miles an hour or more. Models of airplanes are exposed to these high wind pressures while automatic recorders keep tab on their responses to such stresses and strains. The strong and weak points of new styles of flying machines are thus discovered without risking the lives of daring pilots in full size machines which may climb to record altitudes —or fail and crash to ruin.

Testing an Engine in one of the altitude chambers at the Bureau of Standards.

Uncle Sam's altitude chambers can duplicate all atmospheric conditions up to an altitude of 30,000 feet. Aeroplane engines can thus be "flown" under simulated service conditions right in the scientific laboratory. They can be standardized and reinforced for tests "on high" as a result of these invaluable ground experiments.

Federal experts have aided in the compilation of the National Safety Code for Aviation and assist in keeping it up to date. Our haphazard regulation of railroads and automobiles stands as an object lesson for our newest billionaire baby—commercial aviation. History, in this case, is not going to repeat itself. The U. S. Government plans on legislating efficiency and uniformity into our national air service right from sunrise gun until taps. Uniform regulations are prerequisite for state, district and national boundaries, all of which are parts of the passing show to the pilot who sails along in his sky-boat high overhead twice as fast as the record express train travels.

The multiplicity of direct and indirect aviational research fostered by the U. S. Bureau of Standards is so extensive and diverse that nothing more than a mere mention of its ramifications can be made in this article.

Interior of one of the new altitude chambers at the Bureau of Standards.

Definite conclusions have been reached in the testing of certain lubricating oils. They are to the effect that neither the pouring point of an oil nor its viscosity at 99 degrees Centigrade are sufficient to determine its performance in the engine at temperatures below zero degrees Centigrade. The Standards engineers have measured the rate of flow of 35 commercial lubricating oils in a Wright J-4 engine mounted in a cold chamber for research purposes.

This matter of aerial mapping—photographic surveying from the clouds—has even been the subject of certain tests. Some 75 photographic lenses have been tested recently for the Army Air Corps. Particular attention was paid to the determination of the amount of distortion present in the pictures made on high with these various lenses. The purpose, of course, is to eliminate as much of this distortion as possible by the improvement of the lenses.

The flying field at the University of Maryland, 18 miles from the White House, is used by the Department of Commerce in its field and flight investigations. Leading arteries of America's commercial aviation industry cooperate with Uncle Sam in his ever-increasing aeronautical research. You can gain some idea of the extent of these relationships with industry by the fact that 200 scientific, technical and industrial organizations last year cooperated with the Bureau of

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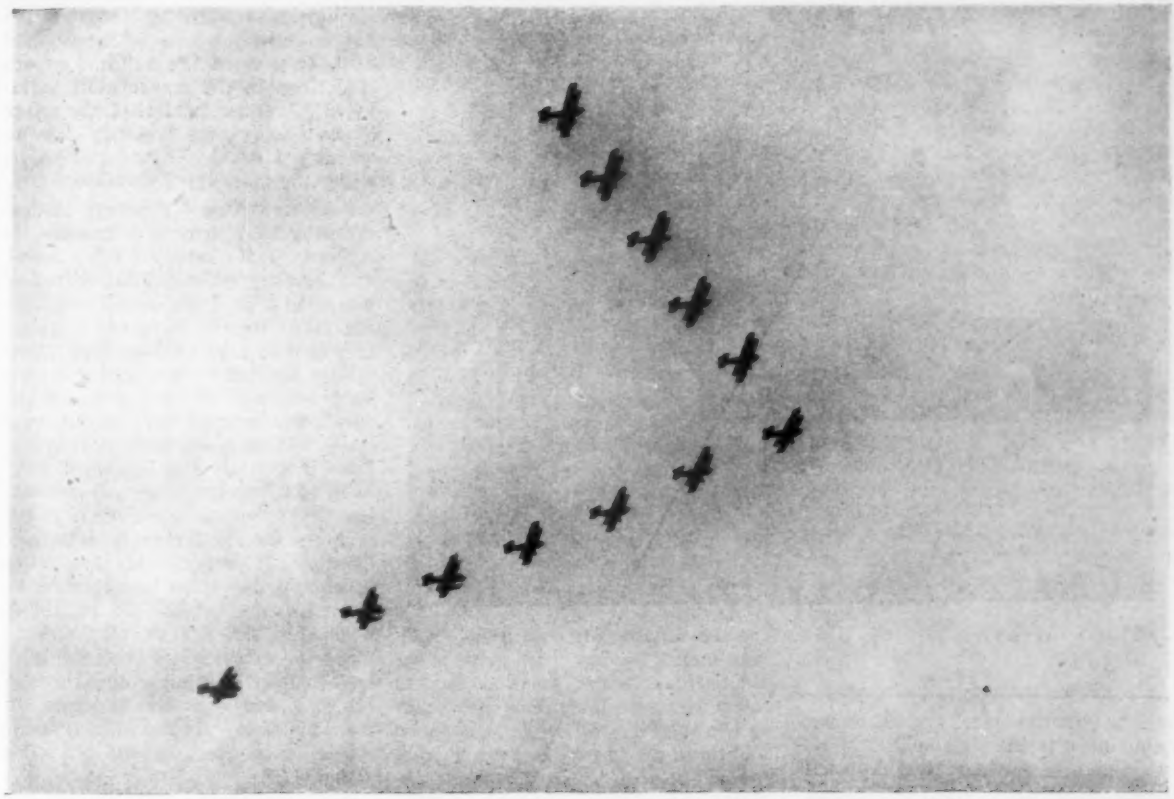

"I do not pretend to be 'up' on Aviation"

An Outsider Looks at Aviation

FIRST of all I want to qualify the self-styled "Outsider" by saying that I am not wholly ignorant of aviation, as I am more than ordinarily interested in aeronautics, chiefly because it touches my business. Anyone connected with transportation realizes that aviation *is* transportation and that no matter what one's personal beliefs or prejudices may be, aviation has a tremendous future simply because it offers the fastest means now known for getting passengers and merchandise from one place to another. That is a cold fact that cannot be ignored, and despite all talk of high costs and other present drawbacks, there will always be numbers of people who are in a hurry and willing to pay for speed, and there will always be merchandise of a nature that needs the fastest means of transportation.

I do not pretend to be "up" on aviation, even though I try to keep pace with developments. I am not familiar with the technical problems of the industry, and it may be that my unfamiliarity may lead me into making criticisms that are not warranted. But I do want to point out a few things that I believe should have attention.

One of our National traits is our ability to get things done in the best possible manner and by taking the short cuts. We have a convenient way of ignoring precedent, but at the same time we do take advantage of the experience of other industries. Consequently one of the questions that comes to mind is whether or not aviation is taking advantage of the hard earned experience of other industries.

It is fairly common to hear aviation compared with the automobile industry. This may be true, but to me the best comparison is to the railroads. The problems of manufacture and distribution of aircraft may be similar to those of the automobile, and I have no doubt that much can be learned from the history and economic progress of the motor car. But, the uses of the airplane, as well as the commercial use of the automobile, is a matter of transportation, and any man who has spent his business life in the midst of problems relating to transportation can see the similarity at once.

At the start let me say that it does not look as if the railroads were going to ignore aviation as they ignored the electric railway and the motor bus. Railroad men are fairly well agreed, now at least, that our great systems overlooked something when they did not at once lay plans to utilize every method of transportation developed; to use the electric railway and the bus line as feeders from the very start, instead of adding them at a later time. Our great systems will not be napping this time, and we have evidence that they will take advantage of the great speed of aviation by some combination of air and rail service such as the Transcontinental Airways.

The first consideration of a line carrying passengers or freight—or express might be a better term in this case—is traffic. A certain definite amount of traffic must originate in the territory served. Lacking that

Traffic requires facilities to move it.

traffic in the territory, the same amount of traffic must be turned over to the line for carriage from one terminal to the other.

Traffic requires several things—facilities and an organization to secure it, to move it and to deliver it at its destination. These facilities imply terminals and rolling stock, and the organization implies staffs for securing business, operating, maintenance and repair, handling, and management. The functions of each are different and yet the management must correlate them into a service for which the public will pay.

Aviation as a transportation business must have each of these facilities and organizations. When I consider aviation as a young giant, not yet grown, but rather taking his first toddling steps commercially, I wonder if those interested in the development are considering all these factors.

Take the matter of terminals as being the first thing necessary. You have to start from a given place and go to a given place. Terminals are not only necessary—they are vital. It is possible to have so poorly located a terminal that all the advantage of speedy transportation is lost. Many of the great railroad "wars" were fought over terminals, and mergers made to give lines access to territories in which they previously had no terminal facilities.

Can aviation afford the well placed terminals the railroads have developed? Certainly the rail lines had the advantage of obtaining cheap land and of having cities grow along their lines, while aviation has to take cities as it finds them and locate in the outskirts, where land is cheap and large tracts may be found. Will the alliance of the rail and air interests mean that runways will be built over the trackage of our railways, close to their passenger terminals? How else can the air transportation company overcome the handicap of fields located from a half to a full hour away from the centers of large cities?

England has a remarkable air terminal at Croydon, near London.

Going a step further—what is being done in the case of established fields to prevent the building of obstructions in the way of tall buildings? I understand that the effect of each story of a building close to an airport is the equivalent of shortening the runway of the field.

Another thing—it is my understanding that there is a definite relation or ratio between flying speed and landing speed. That seems to means that as flying speed increases the plane requires a great distance in which to take off and land. Certainly the limit of speed has not been reached. It will probably be only a few years before the common speed will be twice what it is today. Does that mean that fields will have to be twice as large, or will mechanical developments or a change in design render the larger fields unnecessary? If larger fields are to be necessary, are steps being taken by municipalities which are providing fields for the use of airplanes to make the extension of these fields an easy matter without going through the long and expensive processes of condemnation? Is the industry as a whole interesting itself in this problem?

One of the necessities in choosing terminal sites is that other forms of transportation be available. You cannot dump either passengers or freight on a prairie. Railroads go to great expense to have team tracks and freight houses available to that type of traffic, and to have passenger terminals accessible, and more than accessible—close to the source of the traffic.

Are airports being located on existing transportation lines? Do

the planners consider that proximity to railroads, electric railways, paved roads, hotels and postoffices is not only desirable but necessary? The railroads have found it so. As an example, let me take the city of Chicago. The municipal airport is located in a section of the city that is practically an hour's ride from the business center. I understand that some political considerations are delaying the building of a port that is within ten minutes ride from the center. It should be perfectly obvious that the airport as now located robs the air traveller, and consequently the transport company, of the entire advantage of the time saved in a hundred mile trip. It is very possible that as long as the terminal is so located that traffic for air trips of less than three hundred miles will be nil. Certainly for trips of two hundred miles or less the advantage of air travel is lost when this time is spent in getting the traveller to his actual destination even though you have rushed him almost the whole distance at a speed two and a half times greater than the average of other forms of transportation.

It would be unfair to bring up any considerations about the acommodations for travellers. The energies of the companies engaged in commercial aviation have so far been directed toward the movement of mail and little attention has been paid to the passenger traffic that is developing. I vision the air traveller as a business man to whom time is money, and therefore a man of means—the type that has put the extra fare trains on the railroads. He wants certain definite things—and pays for them. One of the things is speed, but the other is comfort. He cannot be accommodated in a garage-like hangar, he wants a meal, not a box lunch. But—he pays for these things. Certainly the air terminals to be built will take care of him in a comfortable way and will supply him with just what he insists on paying for. I realize that while traffic is meagre it is difficult to supply these things, but they will have to be supplied sooner or later.

Take the rolling stock: Railroads used to carry passengers and freight indiscriminately. If it were possible today, if engines were not capable of pulling enormous trains, even the mails would be separated from the passenger trains and run separately. Just as a side issue, let me insert here my belief that it will not be long before all the letter mail of the country will move by air. Letter mail utilizes the fastest means of transport and the air offers it. It will take time to network the country in order to reach the smaller cities, but it will be done.

I cannot see the indiscriminate carrying of freight and passengers together. Schedules will be different; the necessities of the two kinds of traffic are different. Equipment will be different and the use will dictate the design to a great extent, just as a freight car is different from a Pullman.

Does airplane design at the present time take into consideration the peace-time use of the airplane? I may be making a fatal error here, but it seems to me that we are still too close to the war use of the plane with its demands for quick answer to control and other factors I know little about. But I do know that a motor bus is quite different from a racing car, and yet it owes its being to the developments first tested in a racer.

I have heard it stated that one of the great handicaps of the airplane is that it takes a sixth of a horsepower to move a pound from one place to another. It is a handicap, but is it insuperable? Can design alter this? Are there not possibilities for lighter fuels, lighter engines and greater lifting power? I cannot believe, after viewing the mechanical achievements of the last twenty-five years that we have reached our mechanical limits in anything.

Even should it be impossible to increase pay load beyond six pounds for each horsepower used, that is no reason for thinking air transport has a limited future. The great factor of speed remains and the willingness of the public to pay for speed.

To deal briefly with the organizations let me say that just as with the railroads the public seems most interested in the operating department. Nine out of ten people think of engineers, conductors and firemen when railroad men are mentioned. I suppose nearly everyone thinks of pilots when aviation is mentioned. There are bigger organizations than the operating departments, and they have as much importance. Without them there would be no trains, no passengers to carry or freight to haul. A moment's thought tells you that. But do you think of these others in relation to aviation as a business?

After all, aviation means transportation.

Is the proper attention being paid to the development of the other branches of aviation organization? All the young men want to be pilots. A few will declare themselves as prospective mechanics, but apparently they all want to fuss around the rolling stock. There ought to be at least ten good places on the ground for every one in the air. Are men being trained today for the business of securing passengers in the air? Railroads maintain quite expensive passenger departments.

Who will solicit the business of the shippers? Freight agents have more to do than simply handle freight.

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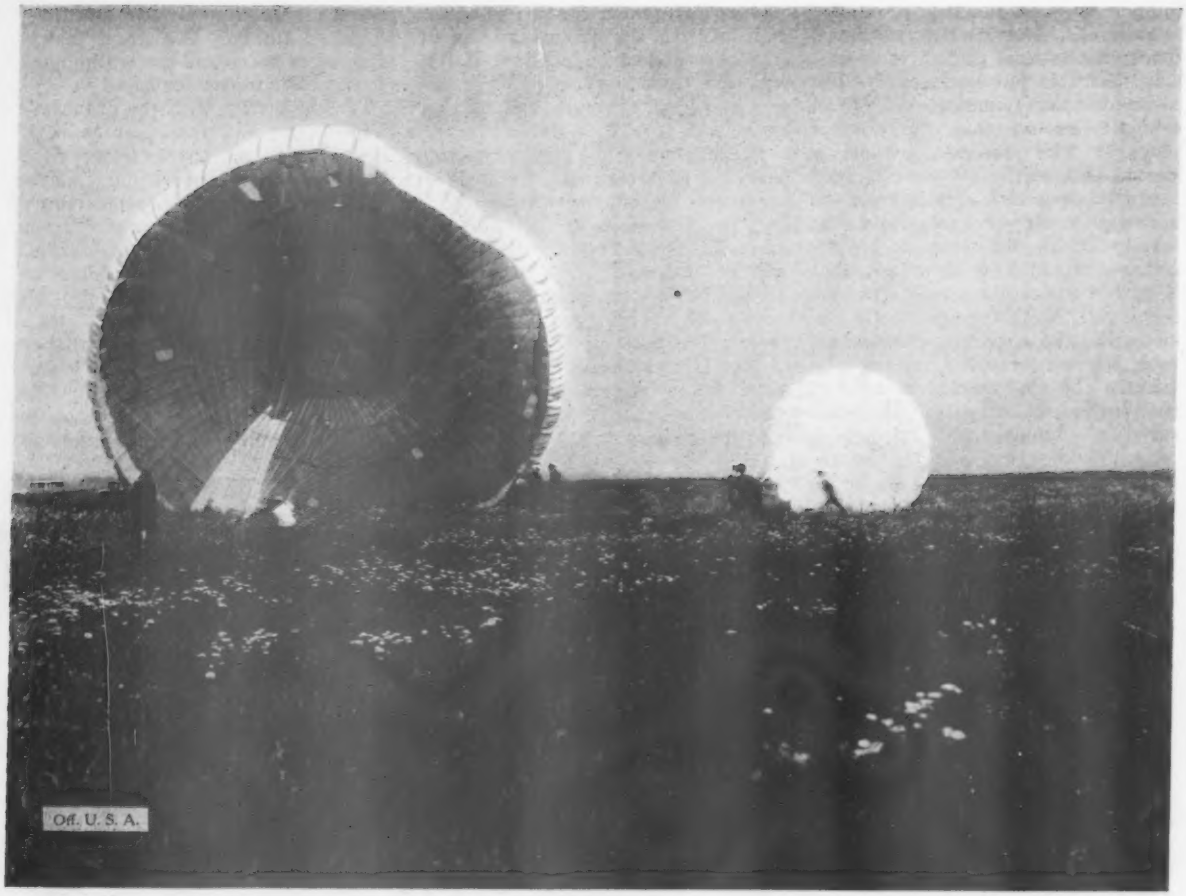


The plane-carrying parachute in comparison with the 24 foot service type.

A Plane-Size Parachute

By S. R. Winters

A PARACHUTE 84 feet in diameter and of sufficient strength to support the weight of an airplane and its passengers, bearing them in safety to earth, has been developed by the Air Corps of the War Department. It is the Goliath of all aircraft safety devices, outstripping by more than three times the diameter of the present standard 24-foot parachute of the United States Army.

At Wright Field, Dayton, Ohio, where this giant parachute was constructed and is now being subjected to tests, a 1,600-pound bomb was used as a weight, a quick-release mechanism insuring the bomb against being dragged by the parachute upon landing. This release device, which in airplane descent would be manipulated by the pilot an instant prior to landing, was pulled after the bomb had reached the ground. Relieved of this 1,600-pound load, the parachute deflated and its appearance has been described as resembling that of the side of a circus tent.

The release mechanism is said to have worked perfectly. A dynamometer or an instrument for measuring force was attached for determining the pull exerted on the parachute with the bumb weight at the instant of opening. This force-measuring instrument was calibrated or carefully checked after the test, and the readings indicated that the force expended was 4,800 pounds compared with 2,000 pounds for the 24-foot parachute, with its usual man-weight. The drop-test, using a bomb instead of man, was successful, the parachute opening smoothly and almost instantaneously.

The preliminary tests with this huge parasol, resembling such when its mammoth billows of silk unfold. were beset with difficulties. This Goliath of all parachutes, with its great lift and enormous strength, demonstrated a disinclination to deflate upon landing and it was equally unresponsive to efforts to halt its racing proclivities across an open field. Singularly amusing must have been the use of an automobile for chasing the errant parachute. The aviator, upon overtaking it, alighted from the automobile and grabbed at the shroud lines of the parachute. His strength, pitted against such a Samson-like structure, was utterly futile and, unfortunately, he became enmeshed in the billows of silk. "At the end of the shroud lines," he relates dramatically, "I could see the 600-pound weight bumping heavily over the ground and thought any moment it would land on top of me. For seconds that seemed ages, I

worked to free myself and had barely maneuvered my body from the path of the weight when it came on, thumping down a split second later upon the spot where I had been."

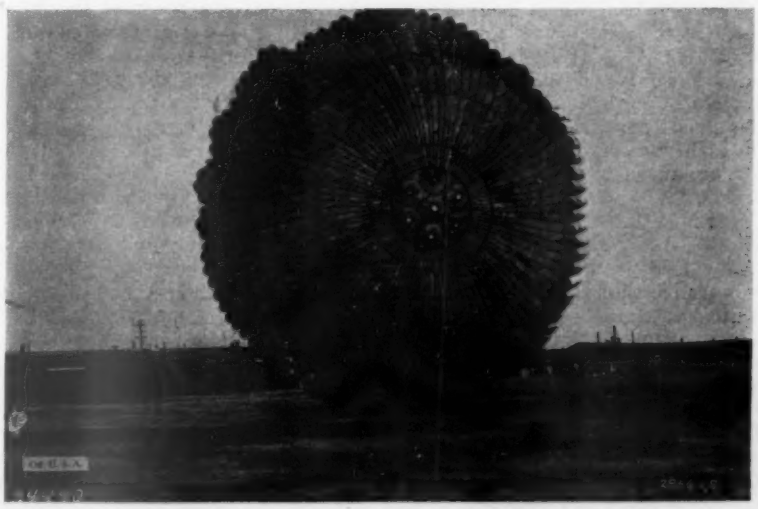
This safety device, which is intended to support the weight of an entire airplane and its cargo instead of just that of one person, as is the case with standard parachutes, was designed by Major E. L. Hoffman. Last year, the Collier Trophy was awarded him for his demonstrated skill in the development of parachutes, Major Hoffman having been responsible for the present standard 24-foot parachute employed by the United States Army. The latter is strictly a man-carrying type, although the new 84-foot design, in structure and material, is a duplicate of, rather than a departure from, the conventional parachute. The vastness of this 84-foot giant of silk is challenging to our imagination and its purpose of supporting an airplane, instead of just one person, staggers our credulity!

Structurally, the air-plane-carrying type is a reproduction, on a mammoth scale, of the man-carrying parachute. There are the usual features—a pilot chute, vents in the dome, and a reproduction of weight and quality of silk in the making of the shroud lines. There are, of course, a greater number of panels and shroud lines in the giant parachute than in the smaller design—96 panels and 48 shroud lines. "Many interesting tests have been performed with the new parachute," reports the Air Corps of the War Department. "Twice," we are told, "it has successfully borne to the ground a 1,600-pound bomb from the bomb bay of a plane, circling at several thousand feet altitude.

"So great is the lift and strength of the 'chute, however, that it shows little tendency to deflate upon reaching the ground and, in the bomb tests, caught by winds, dragged the great weight quite a distance across the field before it could be halted. Men who caught it were lifted unceremoniously in the air and carried along.

"There is still much to be accomplished before the 'chute is ready for the final test of dropping with an airplane. A positive releasing mechanism, separating the weight and parachute upon landing, is in the process of development. This would eliminate the danger of dragging. Perhaps some quick deflation method will also be conceived.

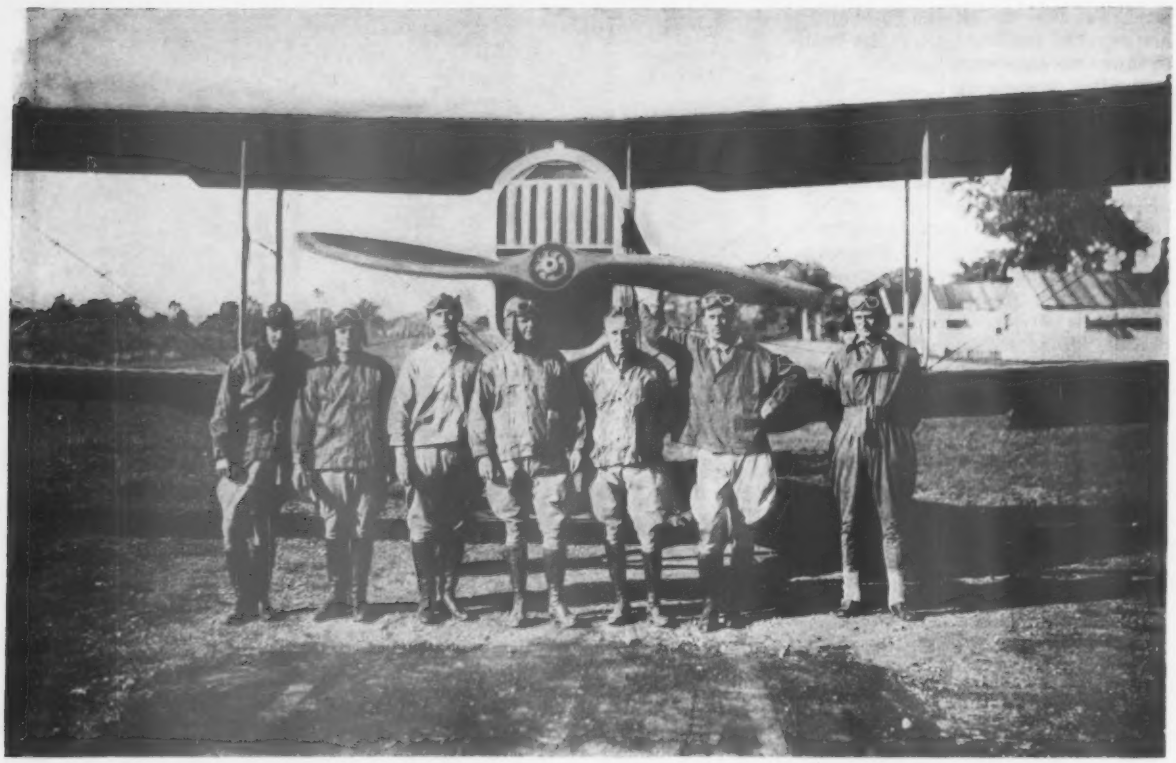
The 84 foot parachute and bomb in loaded position. The bomb was used simply as a weight.



The 84 foot parachute inflated while on the ground.

"Major Hoffman is fully confident of the strength of the 'chute to support a weight equal to that of an airplane with passengers, and the dropping of an airplane with a parachute is, of course, not an unheard of experiment. Two such drops have been accomplished in California. What Major Hoffman hopes to obtain is a parachute of such simple mechanism, ease of application, and reliability of operation as to be practical for all passenger planes—the type of 'chute that will be dependable when manufactured upon a production basis."

Of the human equation—as to what manner of man is this Major Hoffman, winner of the Collier Trophy—we are told interestingly by one of his associates at the Wright Field: "It is quite easy," we are informed, "for those who were at McCook Field in 1920 and 1921 to recall an exceedingly tall, grave person working with great absorption in laboratories, on the field, and in the air with eager assistants on endless billows of silk. They seemed very large, these billows, actually measuring 24 feet in diameter, and in the long run they became the Army Air Corps' parachute, which has proved of such great value to aviators." The tall, grave person was Major E. L. Hoffman, at that time chief of the field's equipment activities, who last year was awarded the Collier Trophy for his efforts in the development of the parachute.



Marine Aviation in Santo Domingo

By Charles E. Hanst
Stinson School of Aviation, Detroit, Mich.

THE Marines did many things for the betterment of civilization in Santo Domingo. They built modern highways; they erected schools and promoted education; they developed sanitation, which prior to their coming was never thought of; and they organized a native militia of ignorant "hombres" into a very efficient organization.

One of the largest factors in this forward movement was the service rendered by the First Air Squadron of the Marine Aviation Force.

In 1921 the First Air Squadron was well established at its base several kilometers east of Santo Domingo City, near the large sugar mills of San Isidro and the field was the center of considerable activity. When the Marines first used airplanes on the island, the base was located at Consuelo, a small town north of San Pedro de Macoris but the location was soon changed for the more suitable site closer the capital city.

The squadron whose insigna was the Ace of Spades was commanded by Major A. A. Cunningham, who was frequently spoken of respectfully as "Ma" Cunningham on account of the almost motherly interest he took in each member of the squadron. The squadron was composed of two flights, "A" and "B," commanded by Captain D. L. S. Brewster and Captain R. A. Presley, respectively.

The field at Santo Domingo City was the base for all operations. Here were located all the supplies, the hangars, machine shops, carpenter shops, electric shops, gunnery shops, photographic laboratory and the various other departments necessary for the operation of the squadron.

There was one steel hangar and three canvas ones, and the hangar detail consisted of about 25 men, under the supervision of Gunnery Sergeant "Bill" Hennemen. While the Marines can boast of the finest pilots in the world, they can also take pride in the mechanics that keep those pilots in the air. The men on the ground are too frequently overlooked, yet they deserve 60 per cent of the credit for the success of any air unit.

The First Air Squadron had "mechanics." Such men as Gunnery-Sergeants Codding and Stroba and Sergeants Priebe, McEnery and Shepard with their crews were the back-bone of the organization. Sergeant Gilliam had direct charge of the test block which he constructed himself, where all motors were tested after overhaul before being mounted in the ships.

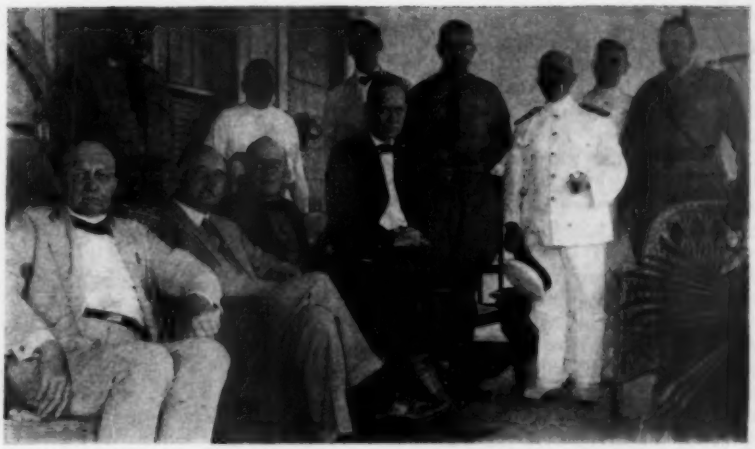
The flying personnel consisted of the command officer, Major Cunning-

ham, who led his squadron on most of the formation flights; Captain Brewster and Captain Presley, whose immediate commands would fight for them; Lieutenants Harmon J. Norton, C. Frank Schilt, Hayne D. Boyden, Duncan W. Lewis and Sergeants C. E. Hanst and R. E. Gilliam. Seargeants Hanst and Gilliam were former officers in the Air Service of the Army who enlisted in the Marines after the war to gain a further knowledge of aviation. Lieutenant Norton, perhaps the ablest pilot of the entire corps, was killed several years later while testing a ship at Anacostia for the Schneider Cup Races. Lieutenant Lewis was killed in a collision in 1922 at Quantico while practicing combat maneuvers, when his VE 7 collided with Lieutenant Randall's Fokker—the latter officer also being killed in the resulting crash.

Lieutenants Schilt and Boyden are now with the Marines in Nicaragua, the former winning the Congressional Medal of Honor there for conspicuous bravery under fire, when he evacuated about a score of wounded from Quilali, constantly under the rifle fire of Sandino's men.

Those were the men behind the Ace of Spades that burned up Uncle Sam's gasoline as fast as it arrived from the States.

A funny incident is recalled about Lieut. Boyden. He left the field one morning on a mail trip and after being gone about 15 minutes, returned to the field. The crew chief of his ship, Sergeant Priebe went running out on the field to ascertain the trouble and learned that all Boyden had returned for was his necktie, which he had forgotten to put on that morning. That partly explains the reason why Lieut. Boyden was affectionately named "Cuckoo."



The Senatorial Investigating Committee, consisting of Senators Pomerene, McCormick, Oddie, Jones, with Captain Day and Col. Russell.

Landing fields were established at most of the important towns and a detail assigned to the ones used most frequently, such as the ones at San Pedro de Macoris, headquarters of Lt.-Col. Wm. C. Harlee, commanding the 15th Regiment, and at Santiago, headquarters of the 4th Regiment. Other important fields were located at Azua, Hato Mayor, San Francisco de Macoris, Puerta Plata, Seibo, San Juan and Barahona. The fields were small and it was no small job to set a ship down in some of them. At Santiago, the rifle range, 600 yards long and 30 yards wide was used. At Azua, a graveyard full of nice white tombstones was only a few feet beneath you on the take-off.

The types of planes used were JN6H Curtiss with 150 Hispano's and DH4B's with 400 Liberty's. Thanks to the best mechanics in the Corps, the hazardous conditions encountered in tropical flying were overcome with a high degree of efficiency.

The duties of the squadron were varied. The entire island was mapped from the air and much valuable information obtained that was used in furthering the development of the country. Regulation Fairchild cameras, mounted in the rear cock-pit of a DH, looking down through the floor, were used for this work and most of the flying was done by Lieut. Schilt. The photographic work was done by Mr. Haquinias and Sergeant Fred Martin.

Regular military mail flights were made to Santiago and San Pedro de Macoris, and mail was carried to other points whenever there was occasion for it. Special dispatches of the commanding general were carried to all parts of the island. Military passengers were transported on authorized orders to any point and persons with important information for the Intelligence Department were rushed to the capital from anywhere.

I had the distinction, if it may be called that, to carry the wife of a bandit chieftain Ramon Natera from San Pedro de Macoris to the capital for questioning by the Intelligence Department. Senora Natero —a sunburned Porta Rican bathing beauty of 170 pounds—rode the entire distance sitting on the lap of Captain Cukela, who was instrumental in obtaining her evidence against the bandits. The Captain's legs were so numb when we reached Santo Domingo City that he had to be helped from the ship. It was a heavy load and the DH was rather tail-heavy.

Special flights of all kinds were undertaken on a moment's notice. I remember several of the "special" ones. The general decided that his appetite craved fish one day and I

The First Air Squadron on the field at Cape Haitian. Lt. Boyden on the propeller.

was deprived of several hours "bunk fatigue" by being ordered to roll out a DH and proceed immediately, if not sooner, to San Pedro de Macoris to bring forthwith the desired food of the sea. Another instance, when all the hens were on strike and the roosters were lax around the camp and eggs were at a premium, I made a hurried trip to San Francisco de Macoris with Lieut. Boyden for as many dozen eggs as we could buy, beg or steal. We managed to get a large basket full, which I held on my lap on the return trip. Coming into the field, Boyden started to dream of some beautiful senorita and pan-caked the old DH down about 10 feet. The result of the dull and sickening thud was a very large sized omelet in my lap. And eggs were still as scarce as ever.

Patrol flights were made almost daily over the territory in which the 15th Regiment was fighting the bandits. Observers of Col. Harlee were flown over the ground to see the action of their troops and dispatches were dropped to the outposts engaging the bandits. On all the flights it was necessary to fly as low as 100 feet to locate the troops, so dense were the jungles—where the slightest motor trouble would have meant an unavoidable crash, perhaps among hostile natives with wicked looking machetes.

As a result of the bandit war and the treatment necessary to subjugate some of the rebels, many complaints were received in Washington about the harsh tactics used by the Marines. So a Senatorial Committee composed of Senators Pomerene, McCormick, Oddis and Jones and Captain Day, U.S.N. was sent to the Island to investigate the conditions there and the reports received.

The Palace of Christophe, the Citadel, near Cape Haitian, Haiti.

Every assistance was given the committee by the aviation force. Beginning in Haiti at Port-au-Prince, they carried the investigation through to Cape Haitian and thence to Santo Domingo.

The First Air Squadron with a formation of seven DH's led by Major Cunningham with Captain Presley, Lieutenants Norton, Schilt, Boyden, Lewis and Sergeant Hanst as pilots flew to Cape Haitian to meet the Senators. Those of them who desired were taken to Santo Domingo City by air and practically all accepted the offer.

Leaving Cape Haitian, the formation was augmented by three ships from the 4th Air Squadron at Port-au-Prince, piloted by Captain A. H. Page, Lieut. H. C. Major and Lieut. Hall—making a formation of 10 ships led by Major Cunningham. The party was flown inland over the ruins of Christophe's Citadel. Only a few hundred feet above the ruins, a wonderful view was obtained of the old fortress, which is a shrine to the native Haitians. It was here the legend says, that the King of the North, in trying to convince an English Admiral that he had the best drilled troops, gave a company lined up for inspection on the walls, the command "Forward March!" Not giving them the command to halt, they marched right over the edge and fell to their death several hundred feet below.

Camp of the First Air Squadron, Santo Domingo City.

The Citadel is situated on the very top of a mountain peak and can be seen on a clear day from Cape Haitian, 40 miles away. It gives to the mountains the appearance of being flat on top. It is accessible only by foot trails and has always been somewhat of a mystery how the stone and materials used in the construction were hauled there to build it.

Remaining in Santiago overnight the formation continued on to Santo Domingo City the next morning. The route from Santiago to the capital runs over some very rugged mountains and dense tropical jungles. Occasionally a large savanna is seen where an emergency landing could be made. Near the town of La Vega, a church is sighted on the top of a high hill, which informs you that you are on the course. This church is supposed to have been built by Columbus on his last trip to Hispanola from Spain. Whether he did or not

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Financial Survey of Aeronautical Industry and Securities

By R. D. Small
General Manager, Aviation Financing & Trading

WITHIN the last six months, investors as a class, have taken more interest in aeronautical securities than in the past six years. Almost everyone who reads the finance page of newspapers has been attracted by the dramatic development in this field, and now has some aviation stock in his strong box, or is scrupuously investigating the possibilities with the intention of soon having some.

A particular situation, offering much room for thought has been observed by many. In almost every bank, bond-house, or investment securities company in the larger cities, you will find a comparatively large number of the supposedly most conservative officials, amongst the holders of leading aeronautical stocks. The banking element, as a class, has reacted very kindly to aviation. In an advertisement of the Ford Motor Company, the aircraft industry was referred to as: "One of the greatest industries the world has yet known." Recent history makes it difficult to keep in step with the remarkable developments in this field. The following are examples:

1. It is reported that air mail carried in one day for one automobile manufacturer, totaled over 18,000 pounds.
2. 100,000 flowers were shipped by airplane in one day from Utah to Chicago.
3. Engines manufactured by the Wright Aeronautical Company numbered approximately 700 in 1927. Today the output is at about double last year's rate.
4. Mono-Aircraft Company in the last several months has jumped from an output of five planes a month to five a day. They secured over 8,000 inquiries from just one ad in a popular magazine. How many automobile companies can report a similar result?
5. Air mail, carried by transport companies, it is estimated, increased over 35 per cent in four weeks, after inauguration of reduced mail rate to 5 cents for the first ounce.
6. Airports have multiplied by nine in the last two and three-fourths years.
7. The business of Chance-Vought Corporation, manufacturers of planes, jumped to over $500,000 per month in July.
8. The United States has recently developed into one of the largest exporters of engines and aircrafts, especially to Europe, South America, Australia, and Japan. Its export business is at the rate of 3.7 times that of 1926.
9. One western transport company has to its credit over one million flying miles since its company began business.
10. Airways regularly traveled today exceed the mileage of all the combined railroads of the world, after their first twenty-five years of development.
11. The making of airplane engines has increased from 1923 to 1927 over five hundred per cent, and the 1928 output is estimated at over four times that of 1927.
12. The continent has been spanned in 18 hours and 58 minutes.
13. Curtiss Aeroplane Co.'s sales for first 6 months is double that of same period in 1927, and it is reported that its earnings increased over 78 per cent.

Such facts in this young industry are of most startling interest, and contain more romance than all the tales in Arabian Nights.

We believe that the present widespread interest in aviation merits the establishment of this financial department. We invite inquiries from our readers and will endeavor to give the latest and most reliable information obtainable relating to investment opportunities in the aeronautical field.

An interesting angle from both the public's and the investor's standpoint is that here is one industry where the approval of the United States' Government must be secured before the vehicle of transportation can be used to carry passengers for profit, and where the driver or pilot must secure a government license before he operates. In no other form of business is the public so safeguarded.

An airplane to be approved by the government passes a microscopic inspection of all its parts. It must perform 100 per cent in accordance with rigid requirements. This constitutes a healthy and needed factor of supervision, not present in any other business in the world.

Another pleasing factor in the transportation end of aeronautics is the absence of over-lapping competing routes, selfish isolation, lack of cooperation, and the like that pervaded the railroad business in its first period of development. The transport companies are working together to establish the best possible basis of time-saving and convenience for their patrons at common airports which happen to be the terminus of several systems. Ticket buying facilities are conveniently located and information is easily accessible.

An effort to consolidate transport lines that meet, is apparent all over the country. These efforts are in the hands of big business interests and presage much in the way of adequate management, cutting expenses by decreasing duplication of executive offices, securing of best obtainable operating personnel, and so on. In other words the industry promises to reach a high level through an early commandeering of brains.

Investment opportunities of an intriguing nature exist in the aeronautical field today, but caution must be exercised, for too many inexperienced companies are getting into that field. The public at large is only acquainted with about three stocks—Wright Aeronautical, Curtiss Airplane, and Transcontinental Air Transport. The first two are listed on the New York Exchange, and the latter on the New York Curb. There

(*Continued on page* 112)

Australia Fosters Civilian Training

By P. B. Prior

OUT in the Sydney. suburbs some eight miles is the Mascot aerodrome from which rises every day the droning song of aeroplanes. Sweeping up from the grey-green open space white Moths flutter in clouds of sunshine, dipping and rising, swerving and swinging against the sky. Mascot, as a suburb, has long grown used to the daily humming note overhead. To the residents of these parts now a plane hurtling along the sky-ways has become almost as common as a cart or lorry lumbering along the roads around them.

Time was not so very long since when the sight of an aeroplane on its way to and from the aerodrome was a subject of comment or conjecture. Flyers came and went to the "air port of Sydney" only on special business. The few planes housed in the hangar were out on odd occasions only.

The New South Wales branch of the Aero Club of Australia has wrought the change. In the daily dance of the Moths like lively midges winging up from the distance and fading away again, the first nucleus of the coming army of civilian flyers is finding its air feet. A score of them have found theirs already. Trained by the club, which commenced these operations in August of 1926, they are now fully fledged private pilots, duly "ticketed" by the Department of Civil Aviation, with access to the club's four machines whenever they wish to go aloft.

Among them is Mrs. M. M. Bryant, the first woman to gain her pilot's license in Australasia. Her example is being followed by three other women, Miss Reardon and Miss Follett, both of whom have already learned to fly, though they have not yet received their licenses; and Miss E. B. Moore, who is waiting her turn on the list to commence her training.

These twenty pilots are the first unit in the army of civilian flyers that the club hopes and believes will in time be thronging the air-ways in the fleets of private and public aircraft of the future. Helped to acquire the air habit, the men will form the reserve from which will come pilots who will take their places in the forefront of any war that the nation is called on to fight.

More than this, the Aero Club is out to see the whole nation develop the flying urge, until the citizens of the future will feel no more qualms on stepping into an aeroplane than it does now in entering a motor car.

And, judging from the crowds that flock to the Mascot aerodrome every week-end to participate in the cheap flying trips that the club, in conjunction with private enterprise, is providing, this object is as rapidly and as successfully being realized as the training of pilots.

The whole-hearted enthusiasm thrown into the venture by the club leaders and members, and President Captain G. F. Hughes, M.C., A.F.C., impressed Major Hereward De Haviland who brought over from Melbourne the new Moth machine that was purchased by the club. Major De Haviland said that the spirit of the progress, alive in New South Wales civilian organization, was the keenest that he had seen anywhere.

Here are the main achievements

of the club in the first ten months of its existence:

Twenty pilots trained gained "A" licenses.

Four pilots gained advanced certificates.

Nine advanced to stage when they are able to fly solo.

Twenty-one on waiting list.

Moth, Mark 2, aeroplane, bought for $1425.

Club house erected at Mascot aerodrome.

Special hangar provided for club's use.

One thousand hours flying since August, 1926.

Fifteen hundred passengers carried, 1000 since January 1.

Keeping on with their policy of advancement, the club has persuaded the Civil Aviation Department to establish an additional hangar at the aerodrome suitable for use as a service station and for the housing of private machines that are expected to increase in number in the near future.

In addition to this the club has urged the erection of a compass swinging base and an air route and weather report bureau of information, as well as other improvements.

Elevated petrol pumps in front of the hangar have already replaced the old laborious method of filling the tanks of the machines by hand.

Busy all day and every day the two instructors, Captain E. W. Leggatt, M.C., and Captain R. M. King, have their hands full, and, with a growing list of those eager to learn, it seems that an additional instructor may be needed.

It was on Captain Leggatt that there fell the duty of preparing the first civilian pilots in Australia to get their "A" licenses.

The actual first "A" licensed pilot was Mr. G. M'C Littlejohn. He was the first club trained pilot in Australia. His license, No. 38, was dated October 13, 1926.

The excellence of the work accomplished by Captain Leggatt received high praise from the Controller of Civil Aviation, Colonel H. C. Brinsmead, when, soon after Mr. Littlejohn had passed, eight other candidates for licenses were passed by Captain E. J. Jones.

In a letter to the club Colonel Brinsmead said:—

"With reference to the pupils who were recently presented by your club for examination for private pilots' license I have to advise that the report submitted by the examining officer is exceedingly satisfactory, and indicates that the flying instruction has been thoroughly and conscientiously carried out."

To the skill and thoroughness of its first instructor, Captain Leggatt, the club attributes the achievement of a satisfactory speed of training. The record of the first three months bore comparison with that of any similar flying club in England, and actually exceeded the record of the London Aeroplane Club.

The quality of the pupils, the club official organ points out, was no small factor in the good results obtained. In a very comprehensive report on the first course of flying training Captain Leggatt said that the pupils were extraordinarily keen, and yet not over confident.

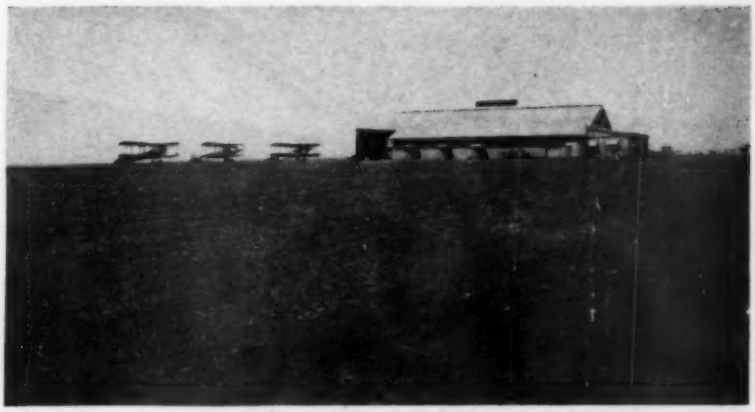
In every way there is abundant justification for the claim in the "Fly Paper," the official communique of the club, that "the advent of the club has put new life into Mascot aerodrome, and has made aviation a reality to a great many people in New South Wales."

Any day the pupils are to be seen arriving at the ground for instructions that usually last about an hour each day. The men drive up in ordinary attire, slip into a pair of shoes, don a flying helmet and goggles, and are quickly aloft.

The women take a little longer. Disappearing to the club house, they come forth again with the dainty garb of feminity replaced by jersey breeches, stout stockings and shoes. The instructors speak highly of their adaptability and progress.

An infectious keenness is the keynote of the busy activity that centers around the club's office and hangar. To spend an hour watching the work of a pilot in the making is to share the enthusiasm that both pupils and instructors put into their tasks.

In a cozy little headquarters after a stirring half-hour in the keen wind in the clouds, learning the mysteries of turns, perhaps making a startling sudden acquaintance with bumps, and, above all, the art of negotiating a landing—the most difficult part of



Three planes of the Royal Australian Air Force. The field is in a treeless plain.

A DeHavilland Moth with a Cirrus Mark II engine, at Longreach, Australia.

elementary flying—pupils and teacher chat over the events of their trip.

Errors are discussed, misconceptions corrected, advice given. In the fund of accumulated experience of the teacher the pupil finds a rich store of help for the manifold difficulties he is grappling with. Perhaps the secret of much of the success that has been achieved in the training lies in the happy relations that exist between instructors and pupils, and which make the free and frank discussion productive of immense good.

Initiation, after a preliminary acquaintance with the mechanism of the machine, begins with dual flights. In the rear or pilot cockpit of the aeroplane the pupil settles himself, his head encased in an unfamiliar furred headdress, goggles completing the disguise, earphone flaps deadening all other noises, save the voice of the instructor which sounds with startling clearness from a speaking tube in the front compartment.

Both cockpits are equipped with complete controls, which work simultaneously.

"Mutton-fisted" or heavy-handed is how the teachers find many of their pupils when they come to handle the control. Unconscious at first of the extreme responsiveness of the light Moths, they swing the handle sharply, and set the craft plunging or wheeling with disconcerting suddenness.

The bigger machines are very different. In some of them it is necessary to take hold of the handle and swing it hard before the great bulk responds. But in the Moths a touch of the finger is all that is necessary.

Soon comes the never-to-be-forgotten day when the pilot goes alone on his first solo flight.

No longer does the voice in front bark friendly counsel at difficult moments, at the start of a threatening spin, at the critical seconds when it is necessary to judge the right poise of the machine for the landing. It is a lonely feeling at first. There are periods when the new fledgling of the air is far from happy.

But the time soon comes when a growing confidence replaces the qualms that rob the first flights of much of their joy. This is when the true joy of flying is born. The fascination of soaring under a peaceful sky, smoothly, swiftly, shooting along at 100 miles an hour, and bounding in a few moments over distances that on earth would take many toiling hours to cover, lays its hold on the flyer never to let go.

At the examination for the "A" license the pilots are subjected to a test for altitude and gliding. They must climb to 6,000 feet, and, shutting the engine off half-way down, glide to a landing within 150 yards of a point determined on beforehand. For skill they are required to describe five figure-of-eight turns at a height of 600 feet, landing the machine, and stopping it within 50 yards of a given spot. They are also required to answer questions respecting international air laws, with reference to lights, signals and rules of the air traffic in the vicinity of aerodromes.

For every pilot trained to the "A" license the Government pays the club $100. It costs on the average $225 for a pilot to qualify to this stage. The charges are $17.50 an hour in the air for dual instruction, and $7.50 in the air solo flying.

The value of the club's work to the country will be realized when it is pointed out that at the present time they are turning out private pilots at a cost to the Government of $100 each, who would otherwise cost the Government $3,650 to train.

Anxious to carry the training of its pilots further than the elementary stage of a pilot's license, the club has established an advanced course of its own, in which the pilots

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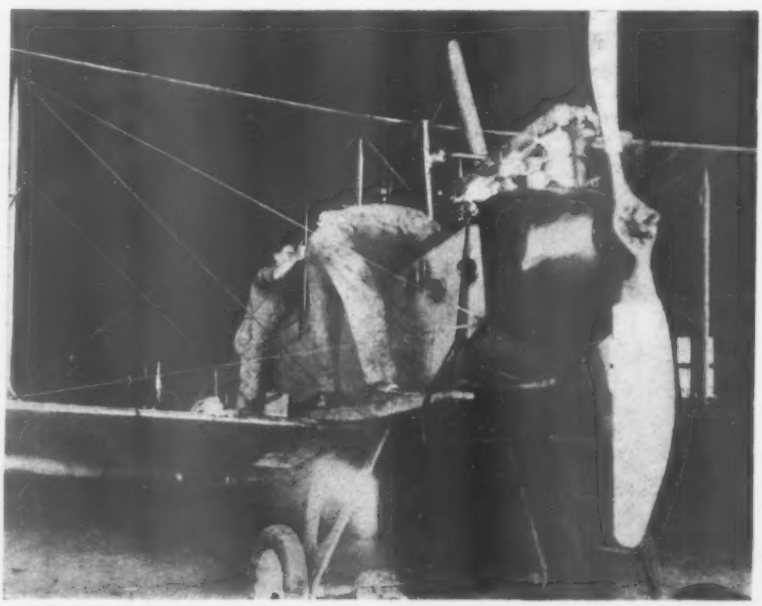


Simple Aerodynamics

An Announcement of Importance

POPULAR AVIATION announces with great pleasure that it has retained Professor Alexander Klemin, head of the Daniel Guggenheim School of Aeronautics of New York University, to write a series of articles on the Elements of Aerodynamics.

These articles have been carefully planned to meet the needs of all those who wish to get a sound fundamental understanding of the principles of aerodynamics.

We believe that a pilot will be a better pilot if he understands the fundamental theory of flight thoroughly, that a mechanic will be a better mechanic if he understands the basic principles on which the construction of airplanes depends, and this opinion applies with even more strength to draughtsmen and others professionally engaged in aviation.

We believe that these articles should also be of use to students both at college and high school, who may be interested in aviation seriously, whether as a profession or as an avocation.

Professor Klemin is one of the foremost authorities on aerodynamics in the United States and has had many years experience in teaching the subject to students of various attainments and has planned this course of articles in serious fashion and will present a sound technical treatment. At the same time the mathematics will be restricted to the most elementary type and the articles will be written very simply. To avoid even elementary mathematics entirely, in this series would have been a mistake and we hope our readers will agree with this conclusion.

We publish a picture of Professor Klemin, seated in his study, and it may be of interest to readers to know something of his career.

Prior to the war, Professor Klemin was instructor in aeronautical engineering at the Massachusetts Institute of Technology and Technical Editor of *Aviation*. During the war, he was officer in charge of the Research Department at the Army's famous experimental station, McCook Field, Dayton, Ohio, and was responsible for the first sand tests and performance tests of air planes conducted by the Army Air Service.

After the war, as consulting engineer, he rendered service to some of the most important companies in the country and was responsible for several important airplane designs and one of the earliest amphibian gears to be put on an American flying boat.

Professor Alexander Klemin.

Acting as consulting engineer to the Air Mail Service, he was one of the potent factors in the successful organization of this service.

He is now director of the Daniel Guggenheim School of Aeronautics, New York University, whose laboratories were designed and constructed under his supervision and constitutes one of the best aeronautical laboratories in the world.

A three year course in practical aviation leading to a certificate of proficiency is now being offered by the Evening Engineering Division in cooperation with the Extension Division of New York University.

The course is intended for those associated with the practical commercial use of airplanes, but have not had the time or the preparation to take a full four-year course in advanced aeronautical engineering offered in the Guggenheim School of Aeronautics.

The training is especially suitable for the ambitious mechanic and professional pilot who wishes to fit himself for executive work in the factory and airdrome, or for an air transport line. The students will study the elemental problems of aircraft design, weather, equipment, airport construction, lighting, air transport and traffic questions.

Professor Klemin explained that this new course was in no way competitive with the work of the Daniel Guggenheim School of Aviation.

"We are particularly fortunate," he stated, "in being able to cooperate with the Evening Engineering Division in giving classes in practical aviation to those students who are not interested in the highly scientific courses in the Daniel Guggenheim School of Aeronautics and who could not pass the admission tests of either the g r a d u a t e or undergraduate schools. The purpose of our four year and post graduate courses is to train engineers rather than aerodynamicists, men who can take part in the practical work of designing, building and developing aircraft and aircraft engines on a scientific basis."

Professor Klemin is frequently consulted as an authority by some of the most important aeronautical organizations in the country, such as the Aeronautics Branch of the Department of Commerce, the Daniel Guggenheim Safe Aircraft Competition, and some of the most important airplane constructors of the day.

He has been responsible for a large number of scientific and technical articles in *Aviation*, *Scientific American* and other magazines and has presented many papers before the American Society of Mechanical Engineers, the Society of Automotive Engineers, reports for the National Advisory Committee on Aeronautics. His textbook on Aeronautical Engineering is known to thousands of students throughout the country.

Simple Aerodynamics

Useful Mathematical & Mechanical Principles

By Alexander Klemin

You do not need to have a college education to absorb and profit by these articles on Simple Aerodynamics. Professor Klemin has written them so that they can be understood by anyone who is willing to study them carefully and go over the doubtful points a second time.

IN the study of aerodynamics as applied to the airplane only very simple formulae and ideas in mathematics, mechanics, and physics are required. It is much better for a student, even if his mathematics is quite rusty, to face these few principles boldly than to try and avoid them. Roundabout verbal explanations are far harder to understand than ideas expressed in simple mathematical language. Once this simple mathematical language is grasped, it is possible to acquire the elements of aerodynamics rapidly, and to apply them with ease in practical problems. In this first article we shall summarize only the most useful principles of mathematics and mechanics.

Constants

If an airplane flies at a steady speed of so many miles per hour, the distance it has flown is said to vary as the number of hours flown. This is expressed mathematically as follows: $s \propto t$ (reads varies as t) where s stands for distance in miles and t for time in hours.

To express the relation of s, t, and speed in the form of an equation, we may denote the steady speed of the airplane by V and write

$$s = Vt.$$

The point to note here is that when s varies as t then s is equal to a constant times t. V is the constant in this case.

If the speed is 60 miles per hour, then the value of the constant, V, is 60 and in three hours of flight, the distance flown will be $s = 60 \times 3 = 180$ miles.

It is quite important to grasp this simple idea of a constant.

Juggling With an Equation

Some of us remember algebra, as learned at school, with pain. Probably because it was taught as an abstract science. It can be quite fascinating when applied to a matter in which we are practically interested. For example in the preceding paragraph

$$s = V \times t.$$

$$\text{Then } t = \frac{s}{V}$$

$$\text{and } V = \frac{s}{t}.$$

If the airplane has flown 360 miles at 60 miles per hour, what is the time taken?

Substituting in the equation $t = \frac{s}{V}$, we get $t = \frac{360}{60} = 6$ hours.

If the airplane has flown 500 miles in 5 hours, what is the speed?

Substituting in the equation $V = \frac{s}{t}$, we get $V = \frac{500}{5} = 100$ MPH.

We shall encounter nothing much harder than such transformations.

Problems in Geometry and Trigonometry

The height of the lowest clouds above the ground in any locality is called the "ceiling" for the locality, and it may be very important to know this in practical flying. To determine the ceiling at night a Ceiling Projector is used. This consists of a searchlight, mounted so as to throw a beam of light upward to the clouds at an angle of 45 degrees to the ground, as shown in Fig. 1.

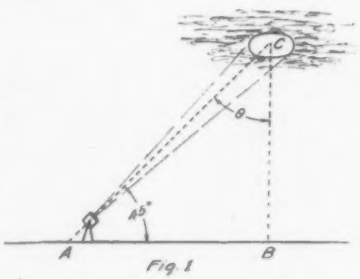


Fig. 1

The operator measures the distance from A to B. B is directly under the center of the spot on the cloud C. He then knows that the distance BC or the ceiling is equal to the measured distance AB. If the angle with the ground is 45° the angle θ* must be 45°. This follows from the fact that the sum of the interior angles of any triangle is equal to 180°. Since the angle at B is 90° then $\theta = 180 - (45 + 90) = 45°$.

We then have a triangle with two equal angles and so the sides opposite the equal angles are equal.

In the example of Fig. 1 it makes no difference what the distance AB is. As long as the angle that the beam of light makes with the ground remains at 45° the distance BC will be equal to AB.

Suppose that instead of pointing the light up at 45° we pointed it up at a much smaller angle, as along the line AC of Fig. 2.

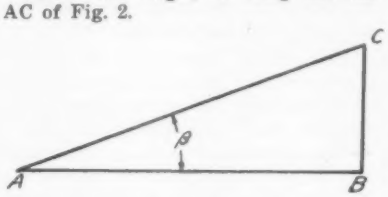


Fig. 2

We can now see that AB is not equal to BC so measuring AB will not of itself tell us the length of BC.

This is where trigonometry comes to the rescue. It is found that for any angle β (pronounced beta) of a right triangle the three sides of the triangle bear definite relations to one another and these relations or ratios are called natural trigonometric functions. Their values are tabulated in special tables, handbooks, and books on trigonometry.

The trigonometric functions most frequently used are the sine, cosine, and tangent, and are generally abbreviated to sin, cos, and tan, respectively.

There is nothing mysterious about these functions as they are simply the ratios that exist between the sides of a right triangle containing the angle, which of course may be any angle less than 90°.

The functions are defined as follows:

$$\sin \beta \text{ (sine)} = \frac{BC}{AC},$$

$$\cos \beta \text{ (cosine)} = \frac{AB}{AC},$$

$$\tan \beta \text{ (tangent)} = \frac{BC}{AB}.$$

In our example of the searchlight projector in Fig. 1, β was equal to 45° and BC = AB.

From this we get

$$\tan \beta = \tan 45° = \frac{BC}{AB} = 1.$$

In the example of Fig. 2 we can measure AB and if we know the angle

*The symbol θ is a Greek letter pronounced theta. Almost all scientific articles and text books use Greek letters to denote angles and it is a great help to become familiar with them.

β we can find BC from the relation

$$\tan \beta = \frac{BC}{AB}, \text{ or } BC = AB \tan \beta.$$

If AB is 100 feet and β is 30° we have

$BC = 100 \tan 30°$, and
$\tan 30°$ is 0.577.

Therefore $BC = 100 \times 0.577 = 57.7$ feet.

The value of the trigonometric functions for the angles 0, 30°, 45°, 60°, and 90° may be easily remembered if one notices the way the following table is built up.

Values of Trigonometric Functions

Angle ..	0	30°	45°	60°	90°
Sin	$\frac{1}{2}\sqrt{0}$	$\frac{1}{2}\sqrt{1}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{4}$
Cos	$\frac{1}{2}\sqrt{4}$	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{1}$	$\frac{1}{2}\sqrt{0}$
Tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

The value of the tangent is obtained by dividing the sine by the cosine.

It is not worth while trying to memorize the values of the trigonometric functions for a large number of angles, but the ones given in the table are so easy to remember and so useful, that they should be committed to memory.

A Problem in Airplane Climb

Watching a very fast airplane climb, people will say that it is going almost straight up like a helicopter. As a matter of fact there is an optical illusion involved, and planes never climb at a very steep angle.

Example:

A fast army plane, climbs 1,500 feet per minute while moving at 90 miles per hour along its flight path. What is its angle of climb to the horizontal?

Sixty miles per hour is 1 mile per minute or 5,280 feet per minute.

$$90 \text{ miles per hour} = \frac{90}{60} \times 5{,}280$$
$$= 7{,}920 \text{ ft. per min.}$$

In Fig. 3 we want to find θ

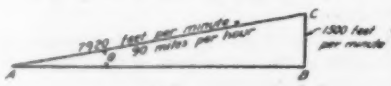


Fig 3

We know that $\sin \theta = \frac{BC}{AC}$

$$= \frac{1{,}500}{7{,}920}$$
$$= 0.189$$

Looking in the trigonometric tables we will find that the angle whose sine is 0.189 is 10.9 degrees. This is much less than one would expect from an observation of the climb.

In Aeronautics, speed is expressed in both miles per hour and feet per second, so it is well to remember the following figures:

Sixty miles per hour corresponds to 88 feet per second.

One mile per hour corresponds to 1.467 feet per second.

Representing Velocity Graphically

It is very convenient in many problems to represent velocity graphically, both in direction and magnitude. Thus if a plane is going 60 miles an hour in a Northeast direction, the motion may be represented by the arrow marked A in Fig. 4. With 10 miles to the unit of length, 6 units will have to be marked off on this arrow.

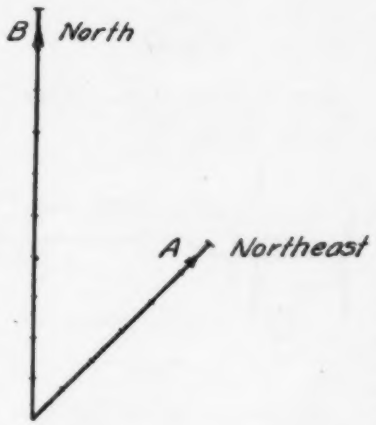


Fig. 4

Going North at 100 miles per hour, the motion may be represented by the arrow marked B, with 10 units marked off.

Relative Velocity and Composition of Velocities

Suppose a train is traveling at 60 miles an hour, and a man in it walks at 2 miles an hour in the train, in the same direction as the train is moving. Then his speed relative to the earth is 62 miles an hour. If he walks at 2 miles an hour in the opposite direction, then his speed relative to the earth is 58 miles an hour.

Similarly a plane traveling 100 miles an hour relative to the air in a tail wind of 20 miles, will travel relative to the earth at 120 miles an hour. If it is in a head wind of 20 miles, its speed relative to the earth will only be 80 miles an hour.

Where the direction in which the airplane is headed, and the direction of the wind do not coincide, it may be convenient to compound velocities graphically. Thus in Fig. 5, a plane traveling due East at 100 miles an hour, in a wind blowing from he Southeast at 25 miles, has a resultant velocity, or velocity relative to the earth of 85 miles per hour, as obtained graphically.

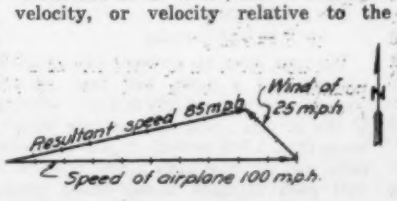


Fig. 5

The same result could be obtained trigonometrically but with a little more trouble.

Forces, Their Resultant and Components

The idea of a force is so familiar to us that it needs no particular definition. Force is merely a push or a pull. Forces may be represented and compounded graphically by the same method we used with velocities.

Thus in Fig. 6, we have an airplane

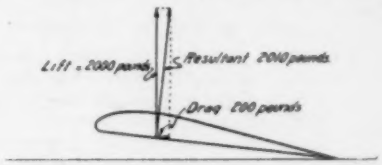


Fig 6

wing with two forces acting on it; one a lift of 2,000 pounds; the other a drag of 200 pounds. The resultant is obtained graphically as shown, and its value is 2,010 pounds.

It is very useful sometimes to split up a single force into component parts. Thus if the resultant of Fig. 6 had been known in direction and magnitude to start with, we could have found the lift and drag components graphically.

Sometimes it is more convenient to find the components of a force by trigonometry. This can be illustrated by the case shown in Fig. 7, where a weight of 10 pounds is at rest on a rough inclined plane which is at 30° to the horizontal. The weight can be

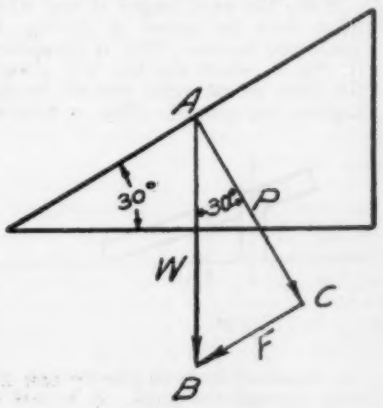


Fig 7

resolved into two components. One parallel to the plane, and the other at right angles to the plane. The force parallel to the plane will bear the same ratio to the weight as BC in the triangle will bear to AB.

$$\frac{F}{W} = \frac{BC}{AB} = \sin 30°$$

so that

$F = W \sin 30° = 10 \times 0.5 = 5$ pounds.

Similarly

$$\frac{P}{W} = \frac{AC}{AB} = \cos 30°$$

so that

$$P = W \cos 30° = \frac{10 \times \sqrt{3}}{2} = 5\sqrt{3}$$

pounds.

Also

$$\frac{F}{P} = \frac{BC}{AC} = \tan 30° = \frac{1}{\sqrt{3}}.$$

This method of splitting up a force will be very useful when dealing with problems in gliding or diving.

Center of Gravity: Moments

Gravity acts vertically downwards on every particle of a body, but every body has a point through which the resultant of these forces acts, and this point is termed the center of gravity. If a bar is supported on a hinge at its center of gravity as shown in

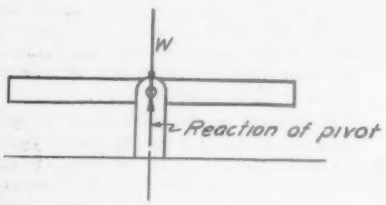


Fig. 8

Fig. 8, it will balance, because the resultant of the gravitational forces passes through the pivot. In other words the center of gravity of a body is the point about which the body will balance no matter what the attitude may be in which the body is placed.

If the bar were hinged at any other point than its center of gravity, it would not balance. This is illustrated in Fig. 9, where the bar will always tilt down on the right side till its tip touches the ground. This is because

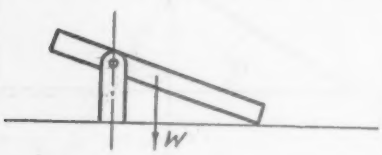


Fig. 9

the resultant force of gravity does not pass through the pivot. It is said to have a moment about the pivot.

The moment of a force about a point is defined as the product of the force multiplied by its perpendicular distance from that point. In Fig. 10 a beam is built into a wall, the beam is 10 feet long, and a weight of 100 pounds is hung at its end. The moment of the weight about the point 0 will be $100 \times 10 = 1{,}000$ foot pounds.

An airplane of course has a center of gravity. It will only move steadily forward without changing the inclination of its wing, if the resultant of the air forces passes through the center of gravity.

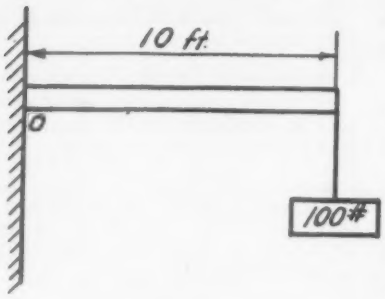


Fig. 10

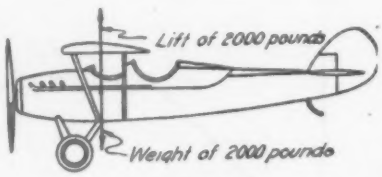


Fig. 11

Thus in Fig. 11, the lift force of 2,000 pounds passes through the center of gravity, and so has no moment about the center of gravity, the distance or arm being zero. But if the attitude of the wing is such that the lift force is ahead or behind the center of gravity, then the moment equilibrium is broken and a force has to be applied at the tail. Thus if the lift force of Fig. 12 is 1.5 feet behind the center of gravity, there is a moment tending to nose dive the airplane, of $2{,}000 \times 1.5$, or 3,000 foot pounds. If the tail post of the airplane is 15 feet behind the center of gravity, the elevator will have to be raised, so that there is a downward force on the elevator. Let this force

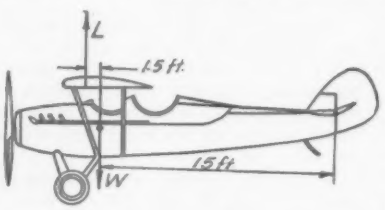


Fig. 12

be F. Then we shall have equilibrium, as far as moments are concerned, where

$F \times 15 = 3{,}000$,

or $F = 200$ pounds.

We now have an upward lift of 2,000 pounds and a down tail load of 200 pounds and the net lift is 1,800 pounds. If the airplane and its contents weighs more than 1,800 pounds it will lose altitude and if less than 1,800 pounds it will gain altitude under these conditions. These ideas will be developed more fully in a later article on longitudinal stability.

Force and Acceleration

While the idea of force is so familiar, it is nevertheless capable of definition in terms of acceleration.

When a body falls through the air, and is so heavy and compact that it meets with scarcely any retarding influence, from the air, it gains a speed of 32.2 feet per second when it has fallen 1 second, a speed of 64.4 feet per second when it has fallen 2 seconds, a speed of 96.6 feet per second when it has fallen 3 seconds and so on. It is said to have an acceleration of 32.2 feet per second per second. This is often denoted by the symbol g, to indicate that this is acceleration due to gravity.

A force which acts on a weight of 1 pound, and gives it an acceleration of 32.2 feet per second per second is said to be a force of 1 pound.

To give an acceleration of 1 foot per second per second to a weight of 1 pound, we shall need only a force of

$$\frac{1}{32.2} \text{ or } \frac{1}{g} \text{ pounds.}$$

So we get the equation

$$F = \frac{W}{32.2} \times a$$

where

F = force in pounds

W = weight in pounds

a = acceleration in feet per second per second.

Work and Power

If a man raises a 100 pound weight 5 feet off the ground, he does 1,000 foot pounds of work. More scientifically expressed, work = force × distance.

The propeller does work in pulling the airplane through the air.

The engine does work in turning the propeller through the air.

Power is not the same thing as work. It is the rate at which work is being done.

When Watt invented the steam engine in the latter half of the eighteenth century, he coined the term horse-power and decided that a horse could do 550 foot pounds of work per second, or 33,000 foot pounds per minute. The definition has been in use ever since.

A problem or two will clarify the meaning of these terms.

Suppose an airplane is pulled by a propeller whose thrust is 500 pounds for a distance of 100 miles in one hour. What will be the work done by the propeller on the airplane and what will be the horse-power delivered by the propeller?

Since there are 5,280 feet in a mile, and work = force × distance, the work done $= 500 \times 100 \times 5{,}280$

$= 264{,}000{,}000$ foot pounds.

(*Continued on page* 119)

Manufacturer and Distributor Problems

By J. A. McInaney

Vice-president in charge of Sales, Alexander Aircraft Company.

THE chief problem of the manufacturer in obtaining satisfactory distributors at this stage of the game consists in the fact that most of those who wish to become distributors are underfinanced. The prospective distributor does not visualize the extent or the possibilities of these distributor franchises a few years hence. The manufacturer, in turn, is anxious for representation and is all too willing to turn his franchise over to a prospective distributor simply in order to secure an outlet in a desirable territory.

The prospective distributor, nine times out of ten, fails to realize the necessity for a well grounded organization capable of rapid expansion. In many cases they incorporate for, say, $10,000, when $500,000 would be nearer the mark in order that they may have available the capital to carry out the plans necessary to make them leaders five years hence.

To secure this amount of financial backing it is necessary to educate the financial interests. In order to sell them a well formulated plan of territory development based on progress to date and a reasonable forecast of what may be expected in the future is an absolute necessity. Capital is shy, but once convinced is a powerful ally. Data, statistics, figures on the actual sales of other distributors should be made available by the manufacturer for the purpose of interesting capital.

As in any other sales organization development the problem is to find men who are willing to work hard, who are willing to fight to obtain a foothold and to maintain it, and who are not ready to lie down at the first sign of discouragement.

A distributor, to be satisfactory from the manufacturer's standpoint and his own, must realize that aircraft sales is not a get rich quick scheme but one which requires pioneering and slow but sure development. It means days, weeks and even months of often-times apparently wasted effort, constant sales demonstrations, follow-up inquiries, reports of activities, card index systems on prospects, investigating and appointing dealers and sub-dealers, apportionment of territory, constant elimination and replacement of weak members and a thorough knowledge of salesmanship, advertising marketing and organization.

The distributor, to be successful, must make the fullest possible use of all the cooperative helps of the manufacturer, must have a knowledge of the manufacturer's problems, and, above all, have a sincere interest in the customer's welfare and needs.

The manufacturer must be prepared to furnish the distributor with certain helps in the form of printed matter. He must back the distributor with advertising to render sales work more effective, and he must co-

J. A. McInaney, Vice-President in Charge of Sales, Alexander Aircraft Company.

operate to the extent of giving the distributor absolute protection in the territory assigned. No other course will breed the loyalty that is necessary or develop a franchise into a valuable asset.

However, there are advantages that offset the disadvantages existing at present. They are such advantages as do not exist in the distribution of almost any other product. Because of its novelty no difficulty is found in securing attention for a sales talk or demonstration. In fact, prospects take no little pride in reporting that they have been called on and in telling their friends that So-and-So is trying to sell him an airplane.

The demonstrator ship is a means of obtaining revenue through passenger carrying, aerial photographic work, commercial carrying, and other activities outside the hours set aside for sales effort. There is a danger right at this point and that is that the organization may swerve from its original purpose of sales and find its chief efforts directed toward these extraneous lines. The necessity for men of proven sales and organization ability should be stressed at this point. These outside activities can be made to produce revenue, and the publicity and advertising value of such work is not to be lost sight of, but an air craft distributor is in business to sell aircraft, not to operate them to the exclusion of sales.

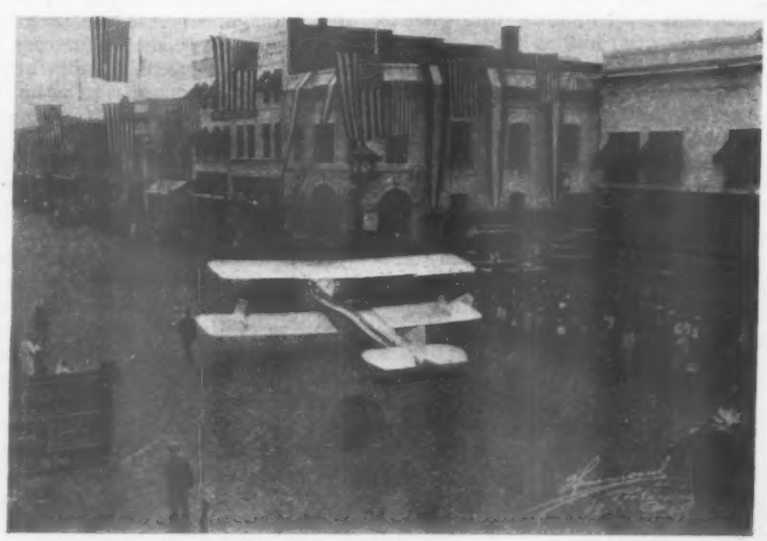
As yet the distributor has not been required to make a large investment in fixed stock and replacements. Thus he is enabled to release more capital for sales development. For the purpose of quick turnover and value of turnover the distributor can have and should have one or more airplanes on the way from the factory at all times. In that way his possibilities for turnover are very great, much greater than the manufacturer himself and much greater than the retailer or wholesaler in any other line. In view of the fact that the fixed investment of the airplane salesman at this time is negligible it gives him an opportunity to invest his capital in movable merchandise.

Then, too, the fact that at present most distributors have no well organized distributor competition furnishes a marvelous opportunity to the wide awake man. He has the field to himself and can lay the foundation for a future business of great magnitude. If he has competition he can take advantage of his competitor's deficiencies. He can plan his sales campaigns with some definite assurance of accomplishment.

The manufacturer, in return for the effort put out by the distributor, must back up his distributors with a complete sales plan if he expects a high standard of representation. Back of this sales plan must be well proven policies which make for loyalty and which recognize the fact that the distributor is the backbone of the business. He must be prepared to give the fullest co-operation and advice on every problem.

It is, of course, a problem of the manufacturer to determine to just what extent it is practicable to assist the dealer and distributor. However, it is a problem in which the dealer should be taken into consideration, and the wise manufacturer, with next year's business in view, and the next year's and the next, permits his distributors to assist in formulating the policies which affect him.

The live distributor never misses the opportunity to get his ship before the public in parades and exhibitions.



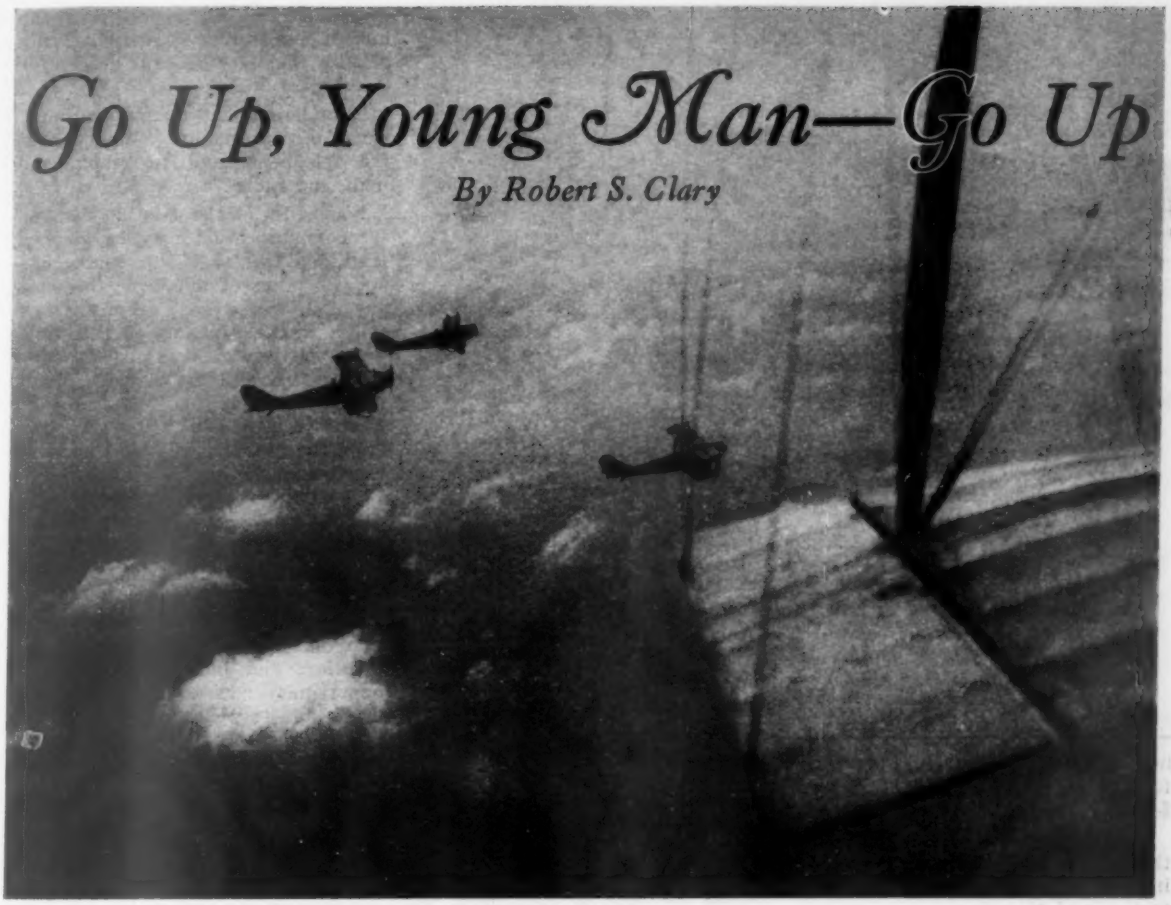
Prospecting by Air

A company, for the purpose of exploring mineral areas over the whole of Canada and developing promising properties to a point where they can be turned over to companies equipped to operate them, is being organized by one of the best known of Canadian mining men, states a report to the Department of Commerce from Trade Commissioner J. Bartlett Richards, Toronto. The capitalization of the new company has not been definitely settled, but there will be, it is said, an authorized capital of $5,000,000 preferred stock, with each share of preferred at $50 carrying with it a bonus of common stock. It is the organizer's plan to establish a number of aeroplane bases at advantageous points.

Small aeroplanes will be used to transport prospectors into the bush and to bring them back quickly to record claims, the report states. Larger planes will then be used to take in engineers with equipment to make more careful inspections and later to take in men and machinery for development work. The company has already ordered four large planes and has provisionally ordered four small planes contingent on their being able to give satisfactory service under the conditions encountered.

Go Up, Young Man—Go Up

By Robert S. Clary



TODAY, J. Harold Smith is a third year student in the Charlotte, N. C., high school. Tomorrow, he may be the Henry Ford of Aviation. By 1948 he may be America's largest manufacturer of popular priced airplanes . . . turning out five thousand $500 airplanes a day.

Within twenty years, 226,948 young men like him—keen eyed, forward looking, sky minded—will undoubtedly be filling highly important, highly paid positions in the aeronautical world. Their combined salaries and wages will doubtless exceed $379,284,935.00 a year. And in all probability they will be making and selling every twelve months some $2,934,488,639.00 worth of airplanes!

Two hundred and eleven of these young men, perhaps, will be presidents of giant corporations engaged exclusively in the manufacture of pleasure planes and air transports. Another 211 will be vice-presidents. And 11,347 will be important executives. Their job will be to make, sell, operate, and service each year the 4,157,830 flying motor cars that may be necessary to take care of new demand and replacement of the 24,452,267 airplanes of all types that experts predict will then be cruising the heavens.

This eventually inevitable consummation spells Opportunity . . . opportunity for tens of thousands of men like Harold Smith, men with vision and soaring ambition, men who realize that their future in flying is almost unlimited.

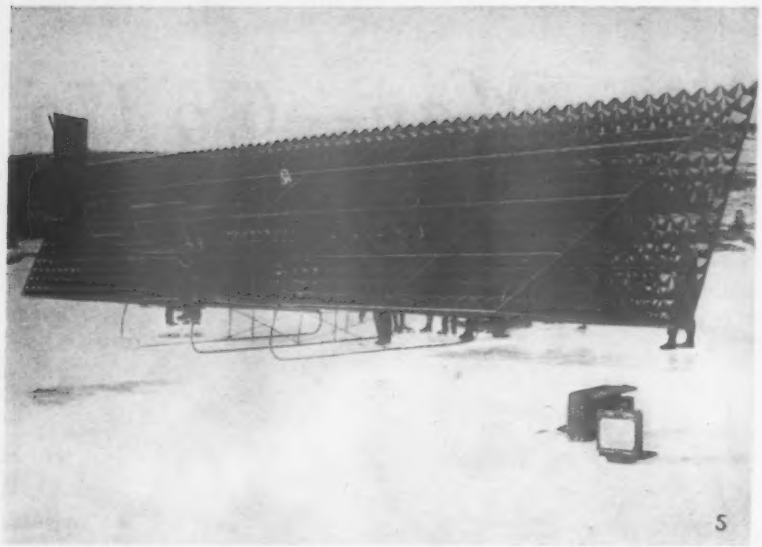
The future of flying is assured by two factors: First, Everybody wants more money; and second, Time is money. Because of these two universal truths, any industry whose operations are predicated on the saving of time invariably grows to colossal proportions.

Moreover, this is the distribution age. The world's chief problem today is no longer mass production. It is mass distribution. And all distribution depends on two elements . . . transportation and communication—both of which are provided to an unprecedented degree by aviation. It is obvious therefore, that the young man who is thinking of his future can profit by thinking seriously of the future of aviation.

Geography itself insures the industry's development. For thousands of miles of desert and mountain and sea are insuperable obstacles to commerce until man's genius provides steamboats, railroads, motor cars, and airplanes.

Just a little over 100 years ago, Robert Fulton piloted the first successful steamboat along the Hudson River while crowds on both banks hooted and jeered. Yet today in the United States there are 567 shipyards, repair yards and boat building establishments employing more than 62,000 men, turning out $213,232,382.00 worth of equipment per year . . . and receiving an additional $112,548,461.00 for repair work. Liners, freighters, tankers, ferries . . . water craft of every class and purpose . . . daily cruise to every corner of the world that can be reached by water. Why? Because passengers, mail, express and freight all demand transportation.

Leaving out passenger traffic altogether, for the moment, the American public pays every year a freight bill of more than five thousand mil-



This tetrahedral kite, built by Alexander Graham Bell of telephone fame, is a far cry from today's airplanes. J. A. D. McCurdy, would-be pilot. May 6, 1896.

lion dollars! And freight revenue for the railroads alone in 1925 was $4,546,670,891.

Let us glance a minute longer at the railroads, to obtain a further insight of the potential demand for faster, and therefore more economical, transportation. If you study a railroad map of the United States, you will see that this vast nation of ours is a perfect network of surface transportation lines. But more important still, you will see a map that looks almost exactly like our airline map will look in all likelihood by 1948.

A few years ago the railroad map of America looked very much like today's airline map. Yet in 1925 the total operating revenue of our railroads was more than 6,000 million dollars . . . to be exact, $6,186,636,000. Of this vast sum which the American public pays each year for rapid transportation, freight revenue accounted for $4,546,670,891 and passenger revenue for $1,055,273,357. And during the first 26 weeks of 1926, exactly 25,036,464 freight cars were loaded with merchandise that had to be moved at once.

Today we have 1,766 railroads, with 251,175 miles of expensive roadway owned and 262,544 miles operated. Of this enormous mileage requiring tremendous outlay for upkeep alone, 250,080 miles are main tracks. Yet there are 189 Class 1 roads whose gross annual earnings exceed $1,000,000 each!

Another conception of the potential demand for aircraft may be formed from the fact that the United States alone now requires 64,370 steam and electric locomotives, 2,349,752 freight cars, more than 60,000 passenger cars, and approximately 1,769,000 railway employes.

Aviation does not require for way maintenance the annual purchase of 170,564 net tons of steel track, nor 77,474,983 cross ties, nor literally billions of board feet of switch ties, crossing plank, fencing, poles, bridge ties and piling. The airplane's tracks are already laid by Nature, and maintained by the same beneficent agent. The tiniest village and the greatest city, regardless of location, are focal centers of a hundred rustless sky-roads . . . radiating in every direction like spokes from the hub of a motorcycle's wheel. *Truly Nature has loaded the dice for Aviation.*

"But how about communication?" some one interrupts. "What about the telephone, and telegraph, and mail, and radio?"

Some idea of the existing demand for communication may be gleaned from the fact that we require 53,000,000 miles of telephone lines for our daily use . . . from the fact that a single company in this comparatively new field is already capitalized at $949,170,350—with plants valued at $2,525,000,000 and total assets of $2,938,003,819 . . . and from the fact that the 1924 monthly average operating revenue of only 13 telephone companies was $48,412,000 and netted $10,555,000 per month.

As for air mail, just ask your postmaster.

These figures by themselves prove the enormous latent demand for aviation, and indicate the glowing opportunity now offered by the aircraft industry. But if you still hesitate, consider the opportunities which beckoned to young men interested in automobiles some 30 years ago, when H. Ford was a bookkeeper for a little coal company; when a burly Chicago cop threatened the Apperson brothers with arrest for driving the first motor car down Michigan boulevard.

Consider the scores of millions who use steamships and railroads

It's hard to imagine anyone "loony" enough to hop off in this plane, which ironically enough was named "The Loon." December, 1908.

The Aeronautical Chamber of Commerce *of America*

invites your participation

in the

International Aeronautical Exposition

to be held in the

Chicago Coliseum

December 1st to 9th, 1928

This Exposition

is to precede the

International Conference on Civil Aeronautics

which has been approved by

PRESIDENT COOLIDGE

to be held in Washington, D. C.

December 12th, 13th, and 14th, 1928

Here is the first water-cooled motor ever installed in an airplane, "The Silver Dart." Novia Scotia, March 2, 1909.

and automobiles today. Estimate, if you can, the billions of dollars invested and earned each year in these gigantic industries . . . industries which in a few short years have already become almost as vitally necessary to our daily welfare as the very food we eat and clothes we wear.

Small wonder that our new infant industry of aviation is now lustily attracting the whole world's attention. Small wonder that enthusiasts now confidently assert that "Aviation is unquestionably destined to eclipse the steamship, railroad, and automobile not only in importance but in magnitude and in profit as well."

Until very recently, any airplane flight created enough excitement to jam all traffic on a busy street; but now the whirring of an airplane's motor receives only an interested glance from the hurrying throng. Why? Because aviation is now an accepted and established mode of modern travel. Its comparatively new experimental work has already covered twenty years, and exacted a total of many lives. But practical perfection has just arrived, and the front page of nearly every newspaper depicts daily the thrill and romance of new feats of progress.

Transcontinental passenger service is now in successful operation daily from coast to coast and from border to gulf. Mail, express and package freight are being transported every hour in the day—safely, speedily and economically by airline. Flying records for speed, reliability, distance, and payload are being shattered with increasing regularity. The aviation wonder of today is immediately surpassed by the achievement of tomorrow. And all this is transpiring before our very eyes. A gigantic new industry which seems destined to become the greatest the world has ever known, is just beginning to kick off its swaddling clothes. Right now it offers every reader of POPULAR AVIATION a wonderful opportunity to get in on the ground floor and grow up with it. It offers to make you an integral part of a marvelous movement. It offers to share its huge profits with you. It offers you excitement, glory, honor and fame. It offers you opportunity!

Although the very first airplane flight in the history of the world occurred no longer ago than December 17, 1903, and lasted only twelve seconds, today no industry can equal aviation for golden opportunity.

The automobile is limited to surface pavement, the railroad to tracks of steel, the seacraft to water of requisite depth. But the airplane moves freely . . . not on a single level as does all other transportation, but multiplies those surface levels a thousand-fold. The airplane requires only airport facilities for landing and taking off. It creates its own track through the air. It is as economical as a good automobile, and almost as convenient. And although still in its babyhood of development, it is already three times as rapid as the average train service.

That this husky infant of the automotive industry will eventually surpass in growth its powerful parent (which in three brief decades has become the largest single industry in the United States) is indicated by the fact that there are over a hundred airplane manufacturers in the United States and Europe, many of which have recently doubled and trebled their production without being able to meet the demand for new planes.

In addition to the army, navy, and marine corps, aircraft manufacturers, air mail contractors, and a host of other airline operators offer ample opportunity to the man who will qualify himself for any one of the hundreds of jobs connected with aviation that are multiplying so rapidly. And the U. S. Air Commerce Act at present specifies no particular educational requirements. This means that anyone who can read and write intelligently, and is gifted with a reasonable amount of common sense, can now get into aviation and with proper training become successful.

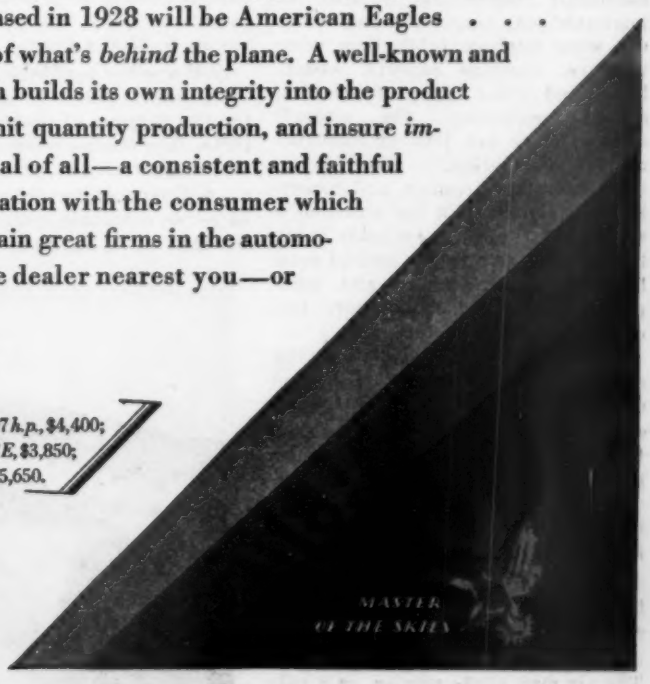
Moreover, one need not necessarily

Can you remember when a cockpit looked like this? Ruth Law "manned" the controls.

Why is the American Eagle the acknowledged Leader?

WELL, naturally, because of the plane itself. Safe, speedy, with never a structural failure, it is today far the most popular among planes manufactured for commercial and private use. In fact, it is estimated that approximately one-fourth the number of all such planes purchased in 1928 will be American Eagles . . . But more than this—it's because of what's *behind* the plane. A well-known and soundly established concern which builds its own integrity into the product it offers. Rich facilities which permit quantity production, and insure *immediate delivery.* And most unusual of all—a consistent and faithful *servicing* of each plane sold: a co-operation with the consumer which can only be compared to that of certain great firms in the automobile industry. See the American Eagle dealer nearest you—or write for interesting information.

OX5, 90 h.p., $2,985; Hisso Model A, $3,500; Ryan Siemens, 97 h.p., $4,400; Quick, 125 h.p., $4,150; Anzani, 120 h.p., $4,800; Hisso Model E, $3,850; Ryan Siemens, 125 h. p., $5,825; Salmson, 120 h. p., $5,650.



AMERICAN EAGLE AIRCRAFT CORP.

KANSAS CITY - MISSOURI

VALUABLE SALES FRANCHISES ARE AVAILABLE IN CERTAIN TERRITORIES FOR WELL FINANCED DEALERS AND DISTRIBUTORS

Lincoln Beachey and the plane in which he first demonstrated the possibility of looping the loop.

fly in order to obtain the rich rewards that aviation offers. For there are some eighteen men in "ground" positions to every pilot in the air . . . positions incident to the manufacture and repair of planes and equipment, and to the maintenance of hangars and airports.

Starting with some of the minor positions in airplane building and repair, the industry must have a constantly increasing number of mechanicians, riggers, metal workers, wood workers, fabric men, wing workers, fuselage experts, assemblers, and other types of practical skilled mechanics. On aircraft motors, there are jobs of construction, installation, maintenance, trouble-shooting, repair and assembly . . . just as in the automobile industry except on a probably much larger scale, as airplane motors must be inspected regularly and completely overhauled much more frequently.

Compensation for such work of course varies, but is considered eminently satisfactory; and many excellent positions await trained men. Higher paid positions include airport superintendents, repair depot managers, general foremen, builders, inspectors, and similar jobs that pay from $50 to $125 per week.

As for the pilots, there are four types: Private, Limited Commercial, Air Mail, and Transport . . . in addition to military and naval. The air mail pilots receive, as a rule $65 to $150 a week; and are usually paid on a guaranteed weekly compensation basis, plus a bonus of about 5c a mile. Some have been known to make as high as $1,000 a month, and average about $18 for every hour of actual piloting.

Aerial photography and surveying is another big-pay profession that is proving decidedly lucrative. Greater New York was recently surveyed from the air, and required 3,000 miles of flight—covering an area of 325 square miles and necessitating 2,000 separate film exposures. Stunt flying, too, offers a profitable field. Numerous big money prizes are being constantly offered and awarded for noteworthy flights. And even barn-storming, or everyday "gypsy" passenger flying, has been known to pay up to $500 a day.

Still another profitable activity for independent pilots is crop dusting for the purpose of destroying insect pests. The charge made for this service is generally $1 per acre; and as an ordinary plane can cover about 75 acres a minute, you can readily see that one's earnings are limited only by the amount of contracts he can sell.

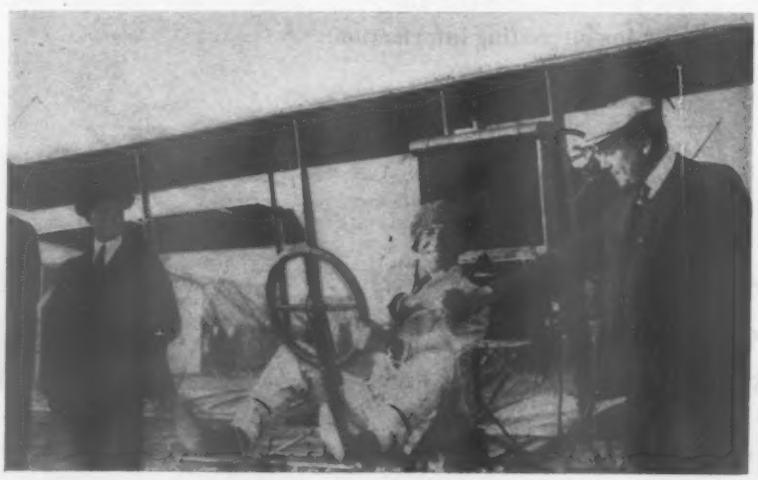
But perhaps the greatest need is for office and technical executives. In addition to the wide range of high salaried inside position, there are many sales openings. Sales managers, distributors, dealers, and salesmen are urgently needed. Just as soon as the right men can be found and trained, the aviation industry will provide as many "selling" jobs as does today's motor car industry.

It is evident, therefore, that there is an almost unlimited field of activity open in air transportation service, even today when the industry is still comparatively adolescent. This condition, however, should not lead would-be aviators to think that the flying game is a bed of roses . . . or to forget that there are in America several thousand potential Lindberghs who have already definitely decided to answer the call of the sky, many of whom have now succeeded in acquiring months or even years of technical training.

One must not lose sight of the fact that all new industries require untold pioneering hardship . . . a singleness of purpose, a stoic disregard of long hours, dirty work, and insufficient remuneration. This prospect, however, will not deter the man of real vision. For he will fix his eyes steadfastly on the ultimate goal. He will literally hitch his wagon to the star of aviation's magnificent destiny. And he will stay with it till he reaps his reward.

Of course there will be many

Pilot Joe Boquelle, daring sky dragon of yesteryear, bidding Oscar Brindley good-bye, just before a momentous hop at San Diego, 1916.



Modern hangar for Dungan Airways, Inc., at the Cleveland Airport, designed and built by Austin. This Company maintains one of the largest and most progressive flying schools in Ohio.

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by the Austin Method

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National Advisory Committee for Aeronautics
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The Pratt and Whitney Aircraft Company
Fairchild Aviation Corp.
Dungan Airways, Inc.
Ohio National Guard
Gray Goose Air Lines, Inc.
Spartan Aircraft Co., Inc.
Logan Aviation Co.

NOW that every city and town is an actual or potential airport, and many new passenger lines as well as mail routes are being projected, the rush to provide ground facilities has become almost a scramble.

At such a time, it is only natural that much may be done which is ill-advised and wasteful. The prudent executive will avoid this by seeking counsel of proved experience in designing and building for aviation.

For more than a decade Austin Engineers have served the aviation industry in a notable way, as evidenced by the list of clients served.

The scope of Austin service to aviation is outlined in a new booklet, the first of its kind ever published, entitled "Airports and Aviation Buildings." If you are an air-minded executive interested in the design and construction of airports or the buildings thereon, directly or indirectly, a copy of this booklet will be sent to you without obligation.

Whatever type or size of building project you may be contemplating—aviation, industrial, or commercial—Austin will be glad to furnish approximate costs and other valuable information, promptly.

Wire, phone or write the nearest Austin office.

THE AUSTIN COMPANY · Cleveland
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Memo to THE AUSTIN COMPANY, *Cleveland*— We are interested in a ..... project containing ..... sq. ft. Send me a personal copy of "Airports and Aviation Buildings." ☐ Individual.....
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Glenn Curtis and the first successful flying boat. The black-bearded passenger is Augustus Post.

isolated instances of meteoric success. There will be other Lindberghs who fly overnight from obscurity to fame, who take off today in penury and land tomorrow in the very lap of fortune. But for every one of these lucky ones, there will be hundreds and mayhap thousands who will wing their way to success only through stern self discipline and grim determination to get into aviation at once and *stay with it through thick and thin.*

They will remember that the population of all the world, merely to exist, *must* have food and clothing—plus transportation to make these two imperative essentials available. They will remember that aviation now addresses itself to the task of moving these two eternal necessities, in addition to moving men and mail and money. They will remember that the only possible circumstance which can restrict the use of aircraft would be shortage of money . . . and to talk about that is comparable to speaking of a shortage of air. There "ain't no such animal" and there never will be.

What the distribution of men, mail, money and merchandise *must* have, to obtain maximum efficiency, is Speed . . . speed in time utility, and speed in place utility. And aviation meets this need better than any other transportation medium ever devised by man. This one reason destines the aircraft business to become as great if not greater than the automobile industry, in order to serve adequately an ever-increasing population that must be fed and clothed every day in the year.

And for that one reason, every reader of this magazine is now face to face with an opportunity to escape the humdrum activities of other means of livelihood . . . an opportunity to fly away from all the petty cares and limitations of an earth-bound existence . . . an opportunity to participate in the upbuilding of an industry that will soon give the whole world wings!

Often you have heard it said that the airplane today is just where the automobile was a few years ago, but that is not true. The airplane of today is far ahead of the automobile of yesterday. If you doubt this for one minute, compare the pictures of yesterday's airplanes which illustrate this article, with the modern planes shown throughout this magazine. Few realize it, but there is in the United States today a greater number of factories turning out airplanes than there are factories in the United States making automobiles! The business of making and operating airplanes has already attained the proportions of a $100,000,000.00 industry annually!

Twenty years ago, who would have predicted that by 1928 forty million Americans would be taught to drive automobiles? Is it, then, unreasonable to predict that within the next twenty years at least 10,000,000 must be taught to fly airplanes?

Aviation schools in existence today will require hundreds of pilots and literally thousands of ground men to teach their proportionate share of these millions. Aircraft manufacturers in the country will require hundreds of test pilots and flying salesmen and literally thousands of ground men to supply the inevitable demand for planes. And within the next two decades the mere making and selling and operating of aircraft may make more millionaires than now exist in any other two industries combined.

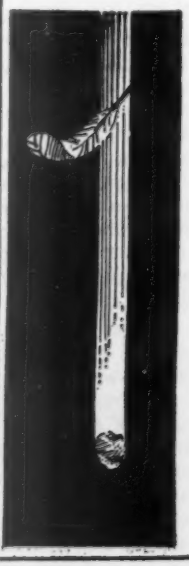
For flying fulfills a universal want and need, and its eventual universal adoption is inevitable. Occasional accidents cannot deter it. A hundred million Americans will not "storage" their motor cars merely because a few crash up. They will not forsake business merely because a few fail.

Of course there are a few timid creatures in the world who claim that they have no desire to fly. They admit that they want to keep at least one foot on the ground when they go up. Poor souls! They are direct descendants of those who

Henry Ford discusses the tremendous future of aviation.

SPEED

BECAUSE ITS AIR RESISTENCE IS LESS



GALILEO

Galileo first told the world, in 1590, why a stone drops faster than a feather—because its air-resistance is less in proportion to its bulk.

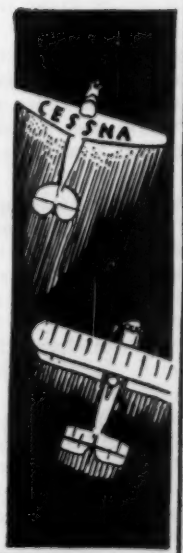
PICK whatever power plant you will, Ryan-Siemens, Comet, Floco, or 200 H. P. Wright Whirlwind, and the Cessna Cantilever Cabin Monoplane will out-fly and out-perform any other cabin plane, Horse-Power for Horse-Power.

Just as the rock falls past the floundering feather, so a Cessna Monoplane, under actual test, will leave behind any other cabin plane of equal horse-power on the market today.

The reason is simple. Cessna builds a plane that slips through the air with unequaled ease. Graceful, specially constructed Cantilever wings, minus the usual struts and braces—slender, compact body, stream-lined throughout—all parts of the Cessna combine to reduce wind-resistance, the great foe of plane speed, to a minimum.

Cessna has not sacrificed one iota of sturdiness, safety, or comfort, either. A glance at the specifications will make this evident.

Send for complete literature and dealer's proposition today. You will find them both more than interesting.



CESSNA

Clyde V. Cessna, first making use of this simple principle in building aircraft, gave the world a plane that is unrivaled in speed—*because its air-resistance is less.*

Cessna Aircraft Company

WICHITA, KANSAS

feared to enter any craft whose only sustenance was water. No sir, if anything happened, they wanted to be on solid ground. And you couldn't have persuaded them to board a railroad train on a bet. Apparently they do not realize that air will support unlimited weight . . . just as will water . . . just as will earth. Apparently they do not realize that billions of birds have been demonstrating daily for thousands of years that air will support bodies much heavier than air . . . just as millions of minnows and whales have been demonstrating for countless ages that water will support bodies much heavier than water.

Fortunately such people are too few in number and too insignificant in importance to prevent aviation from going up, and up, and up, until it takes its proper place in the sun of worldwide activity. While these doubting Thomases are croaking about the dangers of flying, hundreds of virile men are proving that it is possible to fly literally millions of miles without a single accident. And thousands of other forward-looking men and women are reading everything possible concerning flying . . . preparatory to making up their minds definitely to get in on the ground floor of the flying industry.

It is for men and women like these that aviation offers such opportunity—men and women whose vision soars into the future and sees the splendid opportunity that awaits them in the sky.

How will they grasp this opportunity? Some will join the army air corps. Others will join the navy. Still others will try the marines. And a few will get into the air mail. By far the greater majority, however, will avail themselves of opportunities which do not require stringent qualifications and protracted periods of unwanted service . . . opportunities to learn aviation in the shortest possible time and at minimum cost through the various schools and colleges which provide aeronautical training.

Of course the best way to learn to fly is by actually flying. But for those who cannot start their practical flying or engineering training at once, there are a number of excellent home-study courses available. Theory as well as practice is essential in all industries—particularly in aviation. And no one can know too much about the basic principles of flying and aircraft.

J. Harold Smith has never been up but once in his life, but he *has* built models. He *has* read everything that he could get his hands on, on the subject of aviation. And already he knows far more about aircraft than did Lindbergh ten years ago. When he takes up actual flying training immediately upon graduating from high school next summer, he will have a tremendous advantage over those who will have to learn everything from the beginning. For he already knows aircraft nomenclature as well as he knows the alphabet. Furthermore he has learned the theory of flight and hundreds of other technical points so thoroughly that his rapid progress is assured.

Typical of the training in engineering which he may eventaully take, is the course in Aeronautical Engineering provided by the Daniel Guggenheim School of Aeronautics at New York University (located in University Heights, New York City). Here he can devote four or more years to learning the fundamentals of airplane theory and design, aerodynamics, airplane engines and installation; principles of radio communication, trade and transportation, internal combustion engines, advanced applied mechanics, propeller design, applied thermodynamics; materials and methods of aircraft construction, elements of navigation, instruments, meteorology, and other allied subjects.

The entire cost of this training approximates $330 per year. Aeronautical graduates of the classes of 1924, 1925, 1926 and 1927 were immediately placed in suitable positions. Of course, no position can be guaranteed to graduates, but every help will be given in placing qualified students . . . and classes will be restricted to such numbers as can be readily absorbed by the aeronautical industries.

The average flying course begins with dual instruction in straight and level flying; and includes turns and glides; spirals; approaches and take-offs; landings; eights and forced landings; tail-spins; spot landings; acrobatics; vertical banks; side slips; forward slips; fish-tail landings; hurdle landings; solo; and cross country flights. With this is combined detailed instruction in service and maintenance on modern type aircraft, an opportunity to study assembly and factory methods, and a broad ground-course foundation. The complete course requires about six weeks and includes twelve hours of actual flying instruction and a complete ground training.

Some flying schools offer three distinct classes of training: (1) *A primary flying course* for those desiring to qualify as private pilot . . . including thorough dual training and complete instruction in straight flying, vertical banks, spins, stalls, acrobatics, cross country, forced landings, and solo. (2) *An aircraft industrial course* which includes aerodynamics, airplane construction, repair, maintenance, rigging, engine overhaul and maintenance, aerial navigation, meteorology, parachute work, airdrome rules and regulations . . . qualifying for examinations as airplane mechanic and engine mechanic. (3) *A special advanced course* to graduates of the regular flying course who desire fifty hours' training, to qualify as an industrial or limited commercial pilot.

A few aviation schools are in a position to offer students a 250-hour course which qualifies them for a transport license. There is little question that such courses will become more and more popular. Experienced pilots are being hired by all the commercial operators and it will not be long before the supply of men leaving the army and navy will not be sufficient to take care of the needs of the operators. Naturally they will have to turn to the graduates of the schools. Men with hours in the air will be in demand, but they will have to be qualified for the work to which they will be called.

It is not unreasonable to see a remarkable future for the well trained man, and the day of his reward is close upon us.

The Patent Service of Popular Aviation is established for the benefit of our readers. Those who desire to secure copies of the patents described in this section may do so by enclosing 25 cents for each patent desired with their request, which may be sent to the Washington, D. C., office of Popular Aviation, Ouray Building, 805 G Street, N. W., Washington, D. C.

Now the National Airways System announce the Air-King MONO-FOUR—a four place monoplane - whirlwind equipped. Send for full particulars.

AIR-KING AIRPLANES

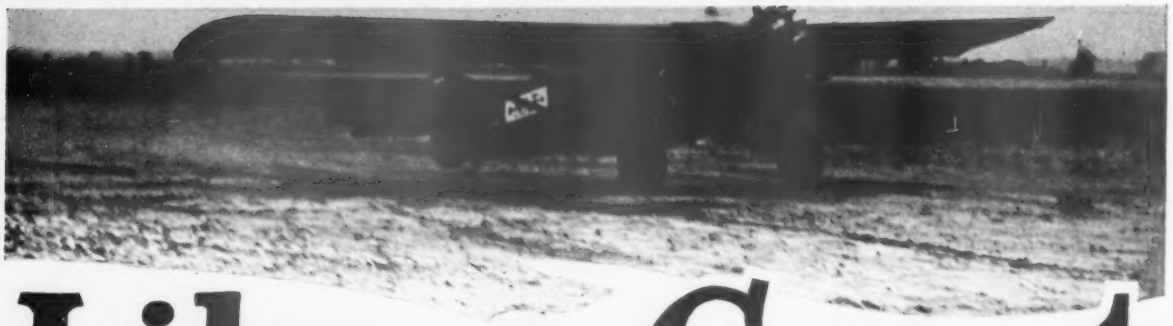
Here, again we list the Air-King refinements that have made this plane more maneuverable, faster, easier to control and safer.

Streamlined flying, load and drift wires—improved shock absorber—split axle type landing gear with hydraulic principle compression struts—push and pull aileron control rods—steel streamlined struts—adjustable stabilizer—ventilated cowling—completely wired for navigation lights—streamlined head rest—full width wind shields—roomy, upholstered cockpits—instrument-equipped dash—finely balanced dual control.

NATIONAL AIRWAYS SYSTEM
Field 6, Lomax, Ill.

Air-King three place biplanes are being built under U. S. Department of Commerce Approved Type Certificate No. 29.

AIR KING MODEL 28



Like a Great

WANTED! 5000 Airplane and Engine Mechanics

Five thousand trained airplane and engine mechanics are needed at once. 50,000 will be needed next year. For every plane that flies, twenty experts are needed in production and maintenance.

Airports are opening every day. New transport lines, new factories, new dealers, and distributors are starting every week. Factories are expanding, doubling and tripling their capacities. "MEN—MEN WHO KNOW AVIATION!" is the cry of the industry.

Parks Air College gives a Complete Course in Airplane and Engine Mechanics, qualifying you at low cost in 4 months as Airplane and Engine Mechanic—ready for a big paying job in aviation. This is a special Course for men who do not want to fly just now—who want a good job on the ground NOW and will fly later. The man who qualifies may rise in a few months to Superintendent, Designer, Engineer, General Manager! Realize this opportunity, then make your start.

$125 a Week

is an average salary for a foreman in an aircraft or engine factory. Graduates of our Advanced Airplane and Engine Mechanics Course can expect to make that in a short time. Some will make more. Many will rise to Superintendent, Engineer or General Manager. Mechanical training is the road to ownership of factories and transport lines. The greatest pilots, the greatest executives of the air, once started as mechanics. They rose fast because they knew the details of airplanes and motors, the fundamentals of the whole business of aviation.

Here's a Complete, Advanced Master Aviation Mechanic's Course

Parks Students learn by doing—by actually performing every conceivable operation on Whirlwinds, OX5, OXX6, Liberty, Caminez and other airplane motors.

They take down and assemble airplanes of many types. They can learn every truss and spar, every wire and turnbuckle, every screw, bolt, and nut! A Parks graduate knows airplane construction from start to finish. All this training is given by airplane, engine and production experts under actual factory conditions. While taking this course you can live right on Parks Airport, in our Dormitories, built especially for your convenience. It will cost you only $3 per week. You can eat in our restaurant so your total living expenses will be only $8 or $10 per week!

Investigate—Get the Facts

Maybe it sounds too good to be true—4 months' training that will make you a master Airplane and Engine Mechanic. But it's a fact. And the demand for men—the opportunity—is tremendous.

The industry is crying for men—and paying unheard of salaries. Ford, Travel Air, Stinson, Swallow, Cessna, Curtiss, Douglas, Waco, Fairchild, Ryan are only a few of the factories that are turning out thousands of ships. Men are needed to build them—to build the motors, to service them, repair them.

Don't delay getting into this great industry until thousands are in. Get your training now while men are scarce and salaries high. Don't let the cost trouble you. Full training in our Complete Advanced Airplane and Engine Mechanics Course is $300. Right now we have a special rate. Men are needed. Our best advertisement is satisfied graduates. For thirty days you can have this $300 Advanced Course for only $215 of which you can earn $50 on the Airport, leaving only $165 to pay in cash for this Complete Course. *But you must come now.*

Mail the coupon with deposit to hold yourself a place at the special rate, then take the next train for St. Louis—for success and fortune. If you want to wait for further information send for a free copy of "The Man Who Tunes the Plane," that gives full particulars. But act now! Many will come at once. *Either you come or send for the booklet today!*

PARKS

Complete training in *every* branch of aviation, that's what Parks Air College offers you!

And now through arrangement with a new $2,000,000 St. Louis Aircraft Manufacturing Corporation, we offer possibilities of a job to every qualified graduate of Parks Air College!

Whether you want to work in St. Louis when you graduate or in any one of the other one hundred airplane factories or on one of the 1500 Airports in the United States—the *first* question your employer will ask is—"Where were you trained?"

Will *you* be able to say Parks Air College? Are you going to get *your* training at the largest and most elaborately equipped Air School in the United States? Remember that to graduate from Parks gives you a definite recommendation.

So come to Parks at St. Louis! Learn to fly on *new* ships, licensed by the Department of Commerce. Fly behind *new* OX5 and Whirlwind motors. Take your instruction under nationally known transport pilots.

Parks Air College has 25 training planes, representing nearly a $75,000.00 investment alone, with 15 transport pilots, nine special buildings—hangars, shops, dormitories, recreation rooms—everything

PARKS Air

206-G Missouri Theatre Bldg.

The Largest Civilian Air

University
Offers Full Training
and possibly a job when you finish!

needed for your comfort and training. Grounds, buildings and equipment represent $250,000.00—no school like it on earth!

Students are enrolled from every state in the Union. Parks is putting many more men into aviation than any other school in the world.

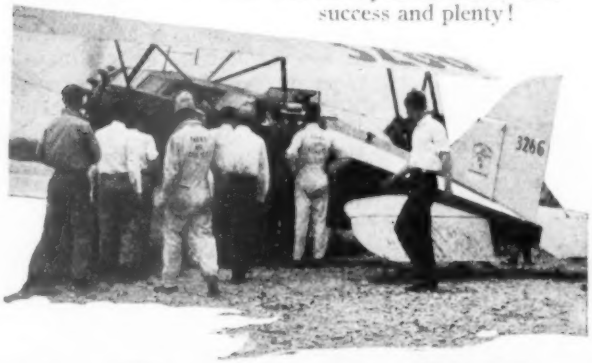
If you could stand on Parks Airport, only 15 minutes from downtown St. Louis, hear giant motors roar into action and see the training planes go sweeping up into the sky—you would be thrilled as we are thrilled with this new, vital industry of aviation.

Department of Commerce statistics show there is need of more than twice as many pilots as there are pilots and students enrolled in all schools in the whole United States combined! This is opportunity!

We do not just teach you to "get by" in aviation. Parks graduates are going out qualified for success.

START NOW

Come *NOW* and get this training that will put you far out in the lead—that will start you on the road to success and plenty!



COMPLETE TRAINING

Right now you can receive our Regular Flying Course and Regular Pilots Ground Course at a saving of $155!

These courses not only teach you to fly, but include Aerial Navigation and meteorology, motor work on such famous engines as Liberty, OX5, Caminez, Whirlwind and others, Airplane Design and Construction, Shop Production Methods, Air Law, and a host of other subjects.

Students are daily choosing Parks after personally inspecting many other schools. One says: "I selected Parks over eight other leading schools. You are decidedly in a class by yourselves."

DON'T DELAY

Come at once to Parks at St. Louis and start your training. If you come *this month* you can have the regular Flying Course and the Regular Pilots Ground Course, *both* for $295 instead of $450! You can save $155 *and in 2 months be ready for a job in the new $2,000,000 Airplane plant now building on Parks Airport!*

Now here is your chance. Come at once. Send a $25 deposit with the coupon to hold yourself a place at the special rate now in effect. Then catch the next train for St. Louis. Delay is dangerous. Or if you want to wait for further information, mark the coupon for our Mechanics catalog, or Flying catalog, whichever you prefer. *But Act Now.*

Parks Air College, Inc.
206-G Missouri Theatre Bldg.
St. Louis, Mo.

☐ I enclose $25 deposit on the $165 rate for the regular $300 Advanced Ground Course.

or

☐ Send me "The Man Who Tunes the Plane."

or

☐ I enclose $25 deposit on the $295 rate for combined Flying & Pilots Ground Course.

or

☐ Send me "Skyward Ho."

Name.....

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COLLEGE *inc.*

Saint Louis, Missouri

School in America

Cadet Life at Brooks Field

By Cadet Dodo

Popular Aviation does not agree with all the statements of Cadet Dodo, but we do think that there is food for thought for air-minded taxpayers in his opinions about the "washouts."

ALTHOUGH the cadets were flying high at Brooks Field the spirits of most of them were often at a low ebb. Each one was greatly concerned with his daily progress and there could be no let down even for a single instant.

From the very beginning of the school up until the time of leaving, which in many cases was all too soon, every single cadet was under a continual nerve racking strain and was filled with a terrible apprehension as to what the future held in store.

"We're here today and tomorrow we may be gone," was the general consensus and a rather short time after the start of flying this thought was forcefully illustrated, especially to those who from time to time were picked for washout.

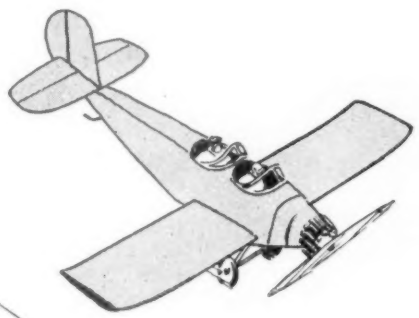
After a few weeks the machinery of the famous Brooks Field Laundry Board was oiled up preparatory to "washingout" a large percentage of the anxious, hard working cadets who were rapidly being singled out for checks and later sent before the board for elimination if they failed to pass the checks.

It is quite obvious that some students will learn more quickly than others and it is also a sad fact that others will never really learn to fly well. The main factor in the cadets' standing and in the grading by each individual instructor is one's daily progress. The most essential characteristic is one's natural ability to fly which according to the conclusions of this school are or at least must be inherent in each student. "Flyers are born and not made" is the assertion and furthermore they even attempt to prove it.

The individual instructor is the crux of the whole problem and upon each one rests the responsibility and actually the decision as to whether or not one finishes or is eliminated from the school.

The instructor outlines the plan of instruction and takes the student through the daily flying routine. He checks very closely on one's judgment, progress, natural ability and the so-called feel of the ship. Detailed notes are taken and daily grades are given for each part of the work and thus the instructor has something definite to work on and tangible evidence upon which to base conclusions and further action.

If the student were making fair progress, that is, as much as could be expected for the amount of instruction, the instructor would pay most attention to those parts of the work that seemed to be giving par-



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With it comes new principles .... new ideas of performance .... of safety .... newer, higher standards in aircraft.

Walter H. Barling, internationally known aeronautical engineer, has a design better than the dictates of your greatest hopes.

It is a monoplane for everyone—a great advance over anything now on the market.

Wait and see the Barling NB-3!

NICHOLAS-BEAZLEY AIRPLANE COMPANY, INC.
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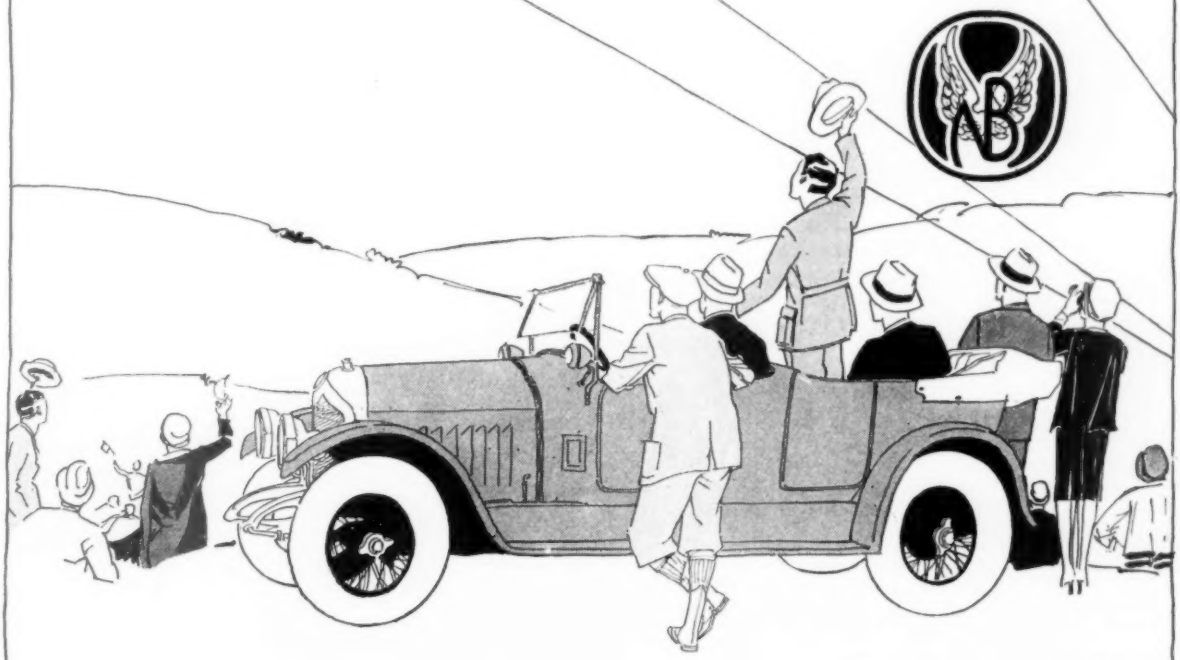

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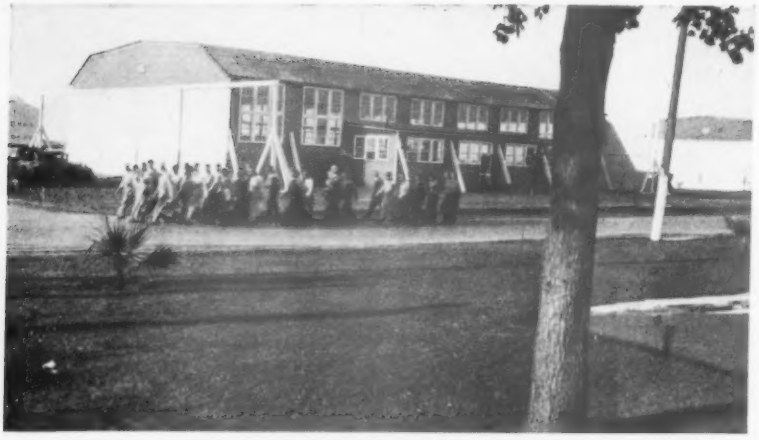


Class returning from flying instruction.

ticular difficulty and proceed to the more advanced work and therefore have more than the usual time for take-offs and landings and also stalls and spins. Stalls and spins are a very important part of the training previous to soloing, as it is essential in safe training methods that the student pilot be equipped to meet emergencies and especially such fundamentally vital and frequently disastrous "exercises" as stalls and tail spins.

After about three or four hours and in many cases earlier, the instructor formed more or less definite conclusions as to whether one would be a "pilot," that is, possess "inherent natural flying ability." From that point on if a student fails to make the necessary progress or in various other ways demonstrates to his instructor that he is not a fit subject for training as a military pilot or an officer in the air service, he is firmly and almost rudely eased out of cadet life forever.

But to get back to the chronological order of the story and more about this later, the question of checks, benzine board, and elimination should be taken up.

But, preceding checks, of course, there is the daily contact of the instructor and the student and the resultant grades on one's ability and daily progress. Starting out with simple turns, climbs, glides and later stalls, take-offs, landings, tail-spins, etc., the training progressed to a point where either the student was to be promoted to solo stage or sent up on check rides with one of the famous trinity of check pilots.

When the instructor detected weaknesses in one's performance special attention was paid to the weaker parts and if, after a rather short period, one couldn't snap out of it the instructor would either hand him over to another instructor or put him at the mercy of a hard hearted and dutiful check pilot.

The most noticeable factor in considering the instructor is that, being men, no two are alike and consequently have vastly different methods and manners of instruction. Some are even mild and seem quite passive, while others, probably the greater majority, are of the rather active type and show their disapproval in no light or congenial manner. A person changing from the mild to the intensely aggressive has the choice of being able to respond and adjust his temperament to fit that of the instructor.

This factor brings up the point of personality, temperament, and even the psychology of instruction. What is probably the greatest weakness of this system is the fact that not only are the instructors of quite different types but also the same is true of the students. However, the fact scarcely seems to be taken into consideration by the school and the individual instructors since for the most part, all students are treated alike by each instructor and taught according to his own methods which may or may not be the best. It is a fact worth mentioning that while all instructors of a necessity are pilots, all pilots are not necessarily instructors and too frequently are not. Besides being a pilot an instructor should be to some extent a psychologist.

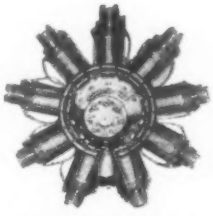
By this I mean to emphasize the idea that since all students as well as instructors are different then they should be treated differently. In order to carry this out each instructor should consider himself as having the responsibility of studying the student, of understanding him, and working out a plan of handling him. Just as an instructor should not and never would have a person doing stalls and tail-spins who had not shown that he could do turns as required, so he should not work at cross purposes to one's temperament and individual make up. The burden rests on the school and individual instructors and not on the students as they are not presumed to know anything about flying and are trying their best to learn while the instructor not only should know how to fly but also to teach others. When flying can get out of the stage of an inherited art and advance to that of scientific acquirement, both the government and commercial aviation will benefit proportionately. It is a rather remarkable coincidence that all the early inventors and pioneers were quite skilled operators either because of "inherent flying ability" or because of considerable experience and practice.

No school or government body can ever feel that they are independent of public consideration or opinion since eventually, however far removed it may be, they are indirectly responsible to the people and depend upon taxes of the citizens paid to

Cutting up

New Plant of the Spartan Aircraft Company, six miles northeast of Tulsa. Accurately reproduced from a photograph taken August 19, 1928.

Dedicated to SAFE Construction



SPARTAN is powered with the world-famous WALTER Engine, manufactured at Prague, Czecho-Slovakia, and holder of five World's Records. Spartan Aircraft Company now controls the exclusive North American distributing rights for this engine and maintains complete stocks of parts at Tulsa and other distributing points.

THE NEW PLANT of the Spartan Aircraft Company, situated six miles northeast of Tulsa and one-half mile from Tulsa's new $400,000 Municipal Airport, is unquestionably one of the finest aircraft manufacturing plants in the world.

The plant consists of two buildings, a main structure, 116 feet wide and 340 feet long, and a dope and lacquering building, with special ventilating equipment, 30x80 feet. These buildings represent the initial unit of a projected $500,000 plant and are of the most modern type of permanent industrial construction.

Equipment is modern in every respect, embracing all of the accepted types of machinery for aircraft manufacture, as well as numberless special jigs and machines designed by our own engineers. Production follows the same principle of operating continuity which is employed in modern automobile plants. Capacity of the plant, operating one shift, is three complete airplanes per day.

Supplementing the facilities of the manufacturing plant proper, are SPARTAN'S permanent assembly plant, hangars, service station and branch sales office at the Municipal Airport.

Span, 32 feet; length, 23 feet, 6 inches; height, 8 feet, 9 inches; weight, empty, 1150 lbs.; capacity, 3 persons and baggage, or pilot and 500 lbs. freight; maximum speed, 115 miles per hour; cruising speed, 100 miles; cruising radius, 600 miles; power plant, 9 cylinder, 120 H. P. WALTER radial, air-cooled engine.

SPARTAN'S new plant, as was the old, is dedicated to the ideal of SAFE airplane construction. Allow us to send you our new catalog in full colors.

SPARTAN AIRCRAFT COMPANY

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Riding the final check

further their progress and well being. The statement by any of the school officials that the limited appropriations make it impossible to carry along any backward students or give them any special attention does not seem logical as one reason for the excessive cost is the excessive percentage of wash-outs. For example the fixed costs, which are high for any aerial operation, would remain practically the same, and the additional operating expense could be set off to a large extent by the corresponding saving due to the training of a larger percentage of the students and because of the fewer wash-outs the proportionate cost for the training of each cadet would be reduced.

After a student was marked as an unlikely pilot and a likely subject for a washout, he was either sent to another instructor or up for a "wash-out check." The student, himself, has the privilege of changing instructors but this is often a dangerous privilege.

The stage check pilot is the first one who is given an opportunity to take a crack at the doomed student and later the head check pilot of the school gets his chance. Both of these individuals have had the opportunity and privilege of checking and checking out hundreds of others and are consequently rather hard boiled. What difference does one student make to them? Just another poor fellow—it's too bad he lacks "inherent flying ability."

After taking the "selected" student for a special try during which time he would carefully check on one's ability, etc., the check pilot would then tell you the sad story. The first of famous triple play combination was firm but very nice about it all and made you feel that, even though he was giving one another push, he was behind it all a good fellow.

"You don't seem to have the 'feel' of the ship," he said, and after a real confiding talk he advised me that the chief check pilot, the Lieutenant Jones, we will say, having checked out far more than he, should be more qualified to make the decision because of his added experience. One could not help thinking just how useless and how much of a formality all these washout checks are since for the most part they were simply a matter of form and there was small chance of one beating them—well, yes, every now and then one does beat a check but not for long. That is, washout checks; not every one checked is for washout as there are other periodic checks as the solo check, the 20-hour check, the 35-hour check, the A stage check, and so on.

The Lieut. Jones, of checking fame, was a good pilot and as a check pilot he was both firm and more or less severe. There was a direct contrast between the two that was very noticeable to the doomed student.

"Well, there's no question about it, you can't fly. You don't have the feel, you are not nearly as far advanced as should be the case for this stage. Your turns were terrible, your climb and glides were abominable (?) and if you call that flying straight to the destination by a series of turns, you're crazy. If I hadn't helped you on the landing you would have crashed, and your landing was bad—yes, very bad. You will meet the faculty board next week."

"How did you make out?" was the question invariably asked by the other cadets.

"That's too bad" was the comforting reply.

Yes, indeed, it was too bad and little that could be said or done could solace the disappointment. A dream shattered and future plans very rudely brushed aside.

"You still have a chance" was the encouragement offered by some cadets.

Quite true, I had about as slim a chance as I had to swim the Atlantic Ocean. But still I persisted in that slim chance and worked out a case to be presented before the faculty board.

The commandant sitting at the head of the board (the famous Benzine) read the charges and asked if there was any defense or that I had been treated unjustly.

"No sir, I have not been treated unjustly, but I feel that if I were allowed more of a chance, I could get through. Six hours in the air is not a very good test, and I know that during certain trials, I could get along rather well but that the change of instructors from the confiding patient type to the violent, rough, and none too gentle type, who grabs the stick from one, shouts back to

(*Continued on page* 118)

Pushing in the ships

YOUR FUTURE

in Commercial Aviation

Look over the outstanding successes in the airplane business today! Granger of Los Angeles, Barchard in Chicago, Johnson in Dayton, Royle in California, and most of the other "top-notchers" elsewhere — all are SWALLOW DEALERS.

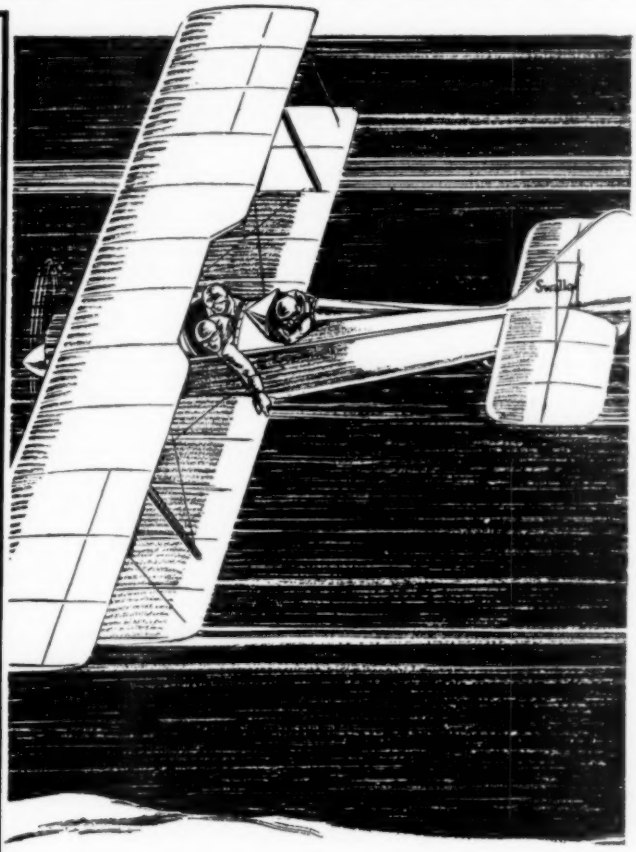
WHY? Because first, in the SWALLOW—America's Pioneer Commercial Airplane—they have a ship to offer the public that is unequalled anywhere for sturdiness, safety, maneuverability, and air-worthiness, and

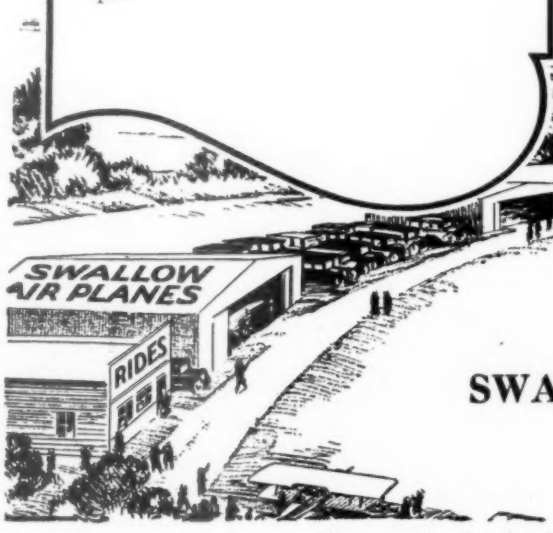
Second—because, with competition increasing all the time, buyers of planes are becoming more and more critical, and a ship's reputation must stand the most rigid investigation in almost every sale.

Just as in every other line of business, perfection comes only after years of experiment and test. When you sell the SWALLOW, you are selling the *oldest commercial airplane in America*—one which has come through ten years of steady progress and constant improvement, culminating in the graceful, sturdy SWALLOW of today.

This is the "clinching argument" in many a sale—and one of the big reasons why the SWALLOW dealer's bank account grows bigger and fatter than any competitor's.

Phone, wire or write us today for full particulars about the valuable Swallow Dealer's Franchise. Your territory may still be open.





Victor H. Roos, General Manager

SWALLOW AIRPLANE COMPANY

Wichita, Kansas

"A Forced Landing in Nicaragua"

By Lieut. W. W. Conway

This is the second "Forced Landing" Prize Story and we know our readers will be interested in Lieut. Conway's experience. More in future issues of Popular Aviation.

Remember — a fine $100 wrist watch each month for the best "Forced Landing" story submitted. Simply mail them to "Left Wing Low" — Popular Aviation, 608 S. Dearborn St., Chicago. Send photographs to illustrate your story if you can.

WE left Puerta Cabezas at 7:45 a. m. June the fifteenth, 1928, a bright, clear morning—but it was during the rainy season. This means that a perfect deluge may fall from the sky at any moment without warning and that a storm may arise with equal rapidity.

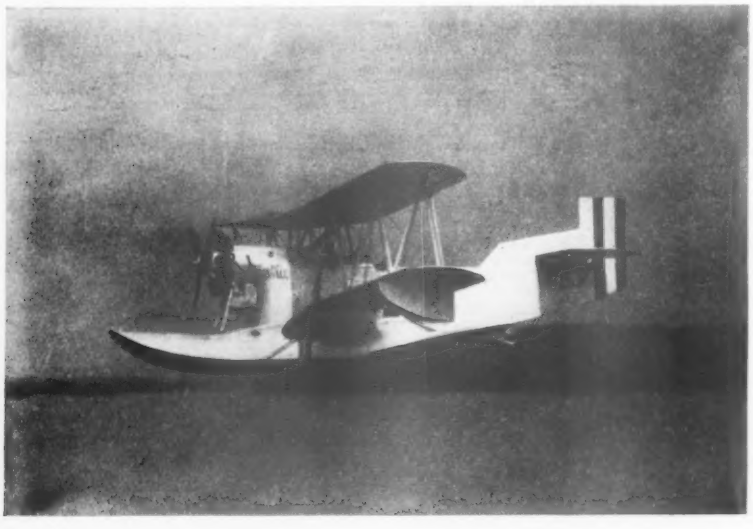
Captain E. D. Howard and I were to take messages to the marines stationed in the interior of Nicaragua. The motor of my amphibian plane X. O. L.-8-7344 purred in perfect rhythm as though to assure me that it would take me safely anywhere, even in a bandit infested territory where captured aviators are not treated according to the standards of modern warfare and where their skulls have been used as mottoes at pep meetings.

All went well. We reached La Luz, where we left supplies and messages. Then our destination was Hiyas, where we were to leave messages for the marine patrol stationed there. As this trip was completed in two hours and we still had a gas supply for four hours' flying, we decided that we should go farther into the interior and try to locate some of Sandino's marauding bands, who were driving terror into the hearts of so many of the inhabitants of Nicaragua.

South of Casca it became necessary to cross a stream, whose swollen, muddy waters seemed harmless enough even though four rafts, carrying about fifty natives, were sighted. As we neared them shot after shot rang out and we knew we were being greeted by Sandinastinos. We immediately returned the greeting with bombs—three of the five dropped from my plane fell true to the mark. The insurrectionists took refuge in the rolling current and those who survived escaped into the woods, where we sent a parting greeting from our machine guns.

Weather conditions began to change very rapidly. It was necessary to discover a hole in the clouds to cross the mountain ahead of us. We headed in an easterly direction and flew fifteen miles to the Lone Star mining area, then west to reach Bocay to assure ourselves that the marine outfit there was safe.

In true Nicaraguan fashion a line squall came up very rapidly, almost without warning, cutting us off from Puerta Cabezas; heavy rain clouds seemed to block our passage on all sides. The only possible escape seemed to be to make a desperate dash to the north. This we did, flying in this direction to the Coca River. Under these precarious conditions we reached Salta de Parsica. Here the storm gathered and raged in all the fury of a tropical storm. The rain poured in torrents from dark lowering clouds and the wind reached such a velocity that Captain Howard and I became separated. Steering my plane in such rough air became a terrible strain. To land was impossible. The country was infested with Sandino's followers. To be captured meant an uncomfortable death. I knew I must reach the coast—the only safe place to land. I sighted the Patuca River; it would be my guide to the sea. But alas! My supply of gas was running low. Fearing the supply would not last until I reached the coast and realizing the danger of landing, I was in a terrible predicament. Finally I decided to land and take my chances. I soon discovered that "chances" were not favorable. The people I encountered were so ungracious, their hostile air so evident, that I thought it best to take the air immediately.



The Loening Amphibian which was stranded.

ANNOUNCING

The
"Cavalier"

A NEW — SUPER PERFORMING — EXQUISITELY APPOINTED — LIGHT CABIN MONOPLANE FOR TWO PASSENGERS.

DEVELOPED FROM THE EXPERIENCE AND DESIGNS OF E. A. RIGGS AND BILLY PARKER—TWO MEN WHO HAVE HAD EIGHTEEN YEARS OF DESIGNING—FLYING AND TESTING EXPERIENCE.

DEALERS AND DISTRIBUTORS NOW BEING SIGNED.

STAR AIRCRAFT CO.
BARTLESVILLE, OKLAHOMA

ONE OF THE SOUNDEST FINANCED ORGANIZATIONS IN THE AIRCRAFT INDUSTRY

There was just one thing left to do—follow the Patuca River just as far as my plane would carry me. The plane functioned perfectly all through these various vicissitudes. The gas supply was almost exhausted, but I had reached the mouth of the Patuca River. I headed south and had gone only a short distance down the coast when the inevitable happened! A forced landing. A bleak and lonely coast far from headquarters, yet close to merciless enemies. I guided my plane to the coast as gently as possible, realizing it was perhaps the last time I should ever do so, but the engine struts cracked, the impact of the plane landing on the crashing breakers caused by the storm was terrible. When the struts broke it allowed the motor to drop down enough to cause the propeller to cut the top of the pontoon. I was forced to land in the breakers, as I was driven by an off-shore wind.

With a pang of regret that was almost a feeling of desertion I decided I must leave my plane to the mercies of marauding prowlers and wild elements while I should seek assistance. Down the coast I started, with many a backward glance at my plane lying there—once so perfect, now so helpless.

We had soared so high, combated the treacherous elements so successfully, to be at last so completely overcome by them.

I, too, should be faithful to the end. I started on that long, hot journey, which consumed miles and hours, with one thought predominant—to salvage my plane at the earliest possible moment. The hot sands burned my feet. That I was hungry and thirsty and only had a few small cans of corned beef did not worry me. I trudged on and on. The sun burned with a terrible intensity. I was drenched to the skin again by lashing rains so prevalent during this season.

Lieutenant Conway and his mascot.

My weary journey on foot was ended. I had reached Cabo Gracias A' Dios. How appropriately I felt this cape had been named! I was now able to wire headquarters for assistance. I had grave apprehensions for my plane. As my walk along the bleak coast ended the tide was coming nearer the shore each moment, dropping its load of sand and pebbles. As the plane from Puerta Cabezas reached Cabo Gracias A' Dios my happiness was mingled with regret. It would still be hours before I could return to my abandoned plane.

When I reached Puerta Cabezas I was greeted as one who returns from death. I had been lost for three days and a half.

In spite of swollen, infected feet and indescribable fatigue I was able to return the next day, Monday, June the nineteenth, 1928, with the crew to salvage my plane, or rather parts of it. My apprehensions were justified. The plane was not to be salvaged intact. The tide had washed such quantities of sand over it that it was impossible to remove the fuselage, so the plane had to be dismantled and the fuselage left on the shore, one more victim of the relentless elements and unfortunate circumstances of the situation in Nicaragua.

The plane being stripped by the salvage crew.

Barcelona-Madrid Line

The new commercial air line between Barcelona and Madrid inaugurated recently will enable passengers to make the trip in 3 hours and 20 minutes compared with 14 hours by train, advises Consul John S. Calvert, in a report to the Department of Commerce.

The cost of the journey is not greater than by rail, as the fare is 180 pesetas ($30.60) which is about the present cost of a first-class railway ticket plus sleeping car charge. From the standpoint of convenience the chief objection of travelers to the route by air at the present time is the fact that the airport of Barcelona is situated at Prat de Llobregat, accessible to the city only by little used and poor roads, and it now takes about one hour and a half to get there by automobile. However, it is stated by local authorities that the road will be put in good condition at a very early date.

The airplanes used in the new service have three motors, are entirely of metal construction, and will accommodate ten passengers as well as two pilots, a radio operator and a mechanic.

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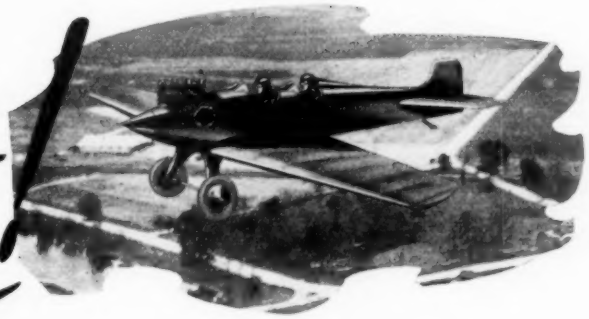

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Lighting the Air Mail

The beacon light that surmounts the sixty-foot tower.

FAR to the north we could see the flash of the air mail beacon light as it made its regular and constant turns, having taken up its vigil for the night, guarding and guiding the air mail on its way. We drove nearer and nearer until we found this particular beacon located in the barn lot of a farm home.

The light of the beacons may be seen for many miles because of the power of the electric lamps and the height of the towers on which they are located. These towers are constructed of steel and are sixty feet high. Six feet extends into the ground and is embedded in concrete or stone. They resemble the ordinary windmill tower except that the height is greater. At the top is a platform five feet square and on this rests the beacon light with its attached motor for revolving the light.

The towers are placed every ten miles regardless of where this location may be. Perhaps it is near a city where electric power may be secured easily or it may be in some farmer's pasture far from such current. In the latter case it is necessary to install an independent light plant similar to those used in many farm homes. There are many such plants in operation on the various mail routes.

The beacon tower is placed in the center of a concrete arrow fifty-six feet long which points in the direction of the mail route. On the feather end of this arrow is painted the tower number in large figures.

At airports the beacons are usually located on the hangar or other building but, in some cases, even here they are placed on the regulation tower. In either case the mechanism and workings of the beacon are the same.

The barrel and base of the beacons are of cast aluminium, light in weight but of ample strength; the weight is about 240 pounds. The barrel is twenty-four inches in diameter and contains a high-grade, silvered-glass, parabolic mirror for reflecting the light rays. It is trunnioned in steel arms mounted on a rotating shaft which revolves in the base on ball bearings. The motor, which is suspended below the barrel, is of one and one-half horse power capacity and revolves the barrel six complete revolutions per minute. The rotating shaft carries collector rings for supplying current to the lamp and a worm gear which engages a worm on the motor shaft. A sheet metal door attached to the base may be removed for easy inspection of the rotating mechanism. The plate glass door to the barrel is hinged and held in place by a number of strong clamps.

An automatic lamp changer is provided for lighting a second lamp if the original should burn out. This mechanism is really two sockets each holding a light and so connected that in case of lamp failure, the second lamp automatically lights. These lamps are 1,000 watts in size and produce a million candle power of light.

Just inside the door is a stray light shield. This is a metal strip about an inch wide shaped like a watch spring. Its function is to keep rays of light from striking surrounding buildings.

In a metal box at the base of the tower are placed the meter for measuring the amount of current consumed and the automatic time clock for turning the lights on and off. This latter devise is similar to that used to operate store window lights and may be set to function at any hour of the day. It is set to turn

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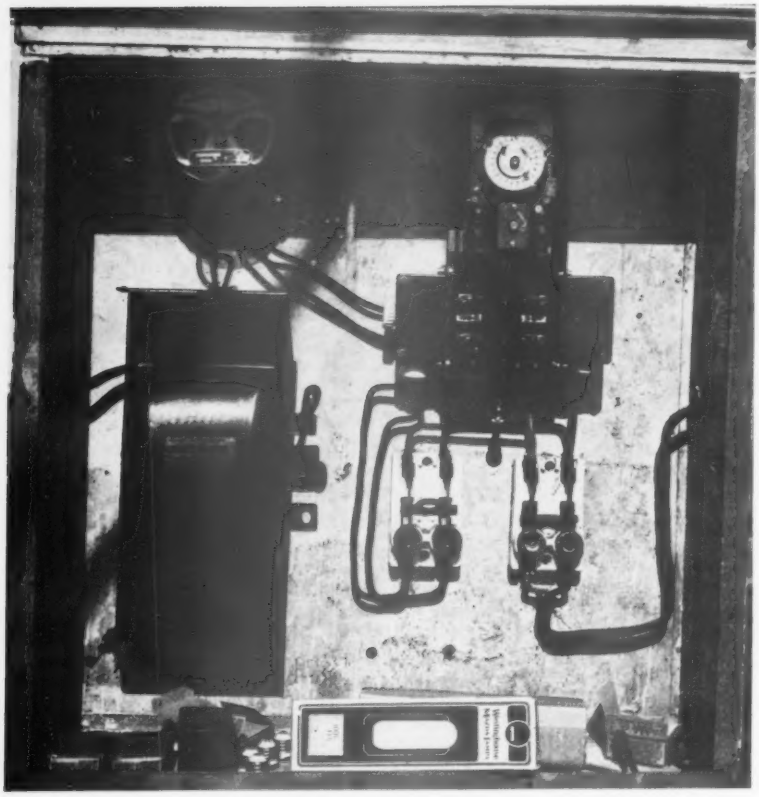

The meter and automatic time clock are located in a metal box at the base of the beacon tower.

the lights on at sundown and off at sunrise the next morning.

An emergency landing field in located every thirty miles. It is an open area of ground suitable for safely landing aeroplanes in an emergency such as engine trouble, storms, or other unusual troubles.

At night the fields are outlined with white lights which are placed on standards three feet high and spaced 300 feet apart. The size of the field is thus indicated by the number of lights in the outline. The base of the standards is buried eighteen inches in the ground and covered with concrete or crushed stone. Wiring is underground.

If landing is impossible from any side, fixed red lights are installed in the border instead of the white. If a grove of trees or other obstruction is nearby which must be cleared by machines in landing, flashing red lights are mounted thereon or on poles of equal height of the obstruction. Radio towers, telegraph and telephone lines, and bridges in the vicinity of landing fields are all marked in this way. If quite tall, a second light is placed midway between the top of the obstruction and the ground.

The Department of Commerce, which directs the air mail, recommends that all villages, cities, and towns mark the name of the place on the roof of a prominent building and, at night, flood it with light. It recommends also that landing fields be provided at all towns and that an arrow pointing toward the field be painted with the name of the place and included in the lighting.

The cost of maintaining this vast network of beacons over the many air mail routes may be estimated from the cost of maintaining one such light and landing field.

The list price of the beacon light including the motor but without the steel tower is $475.00 with $50.00 added for the automatic lamp changer. The cost of the lamps, which have a life of fifty to sixty hours, is $6.50 each. If burned ten hours each night this would mean a new lamp every five or six days. The current consumed to run the motor and light the lamp, at five to ten cents per kilowatt hour, amounts to $50.00 to $80.00 per month. It is necessary to keep a maintainer at every tower and for this service the average pay is $5.00 per month. This keeper is usually the man on whose land the tower is located and whose duties are the reporting to the general maintainer any failures in the beacons and the replacing of old lamps, when burned out, with new ones. Rent of land for the tower, a strip approximately ten by sixty feet, is $5.00 per year.

At landing fields the cost is much more, due to the many lights for outlining the field and the red lights marking obstructions. The list price of the border light standards is $13.50 and the number may vary from twenty to a hundred or more of 50 and 100 watt size.

Men regularly employed by the Government have several hundred miles of air route beacons to keep in repair and make regular trips over them making any adjustments or repairs necessary. They are also subject to call to any tower at any time when troubles arise which the local maintainer cannot adjust. These men travel in trucks with necessary supplies which, with their salary, makes another good sized item of expense.

Thus it is seen that with the many air routes over the country all marked by powerful lights every ten miles, with emergency landing fields every thirty miles with the many lights, the airports with beacon and flood lights, the lighting of the air routes is quite expensive. Added also are the salaries of employees, rent of land, and many other such items of expense.

Weather Reporting System

A complete weather reporting and communications system similar to those now in operation on several civil airways in the United States is planned for the New York-Atlanta airway.

An inspection trip over the entire route was made recently by Thomas H. Chapman of the Airways Division and W. R. Gregg, Chief of the Aerological Section of the Weather Bureau. They recommended a new upper air station at Greensboro, N. C., for weather observations for the use of pilots flying over the Atlanta route.

The Weather Bureau now maintains complete aerological stations at Hadley Airport, Cleveland Airport, Cicero Field (Chicago). These stations are at the eastern end of the transcontinental airway. A new aerological station has been established recently at the Salt Lake City Airport, at the western end.

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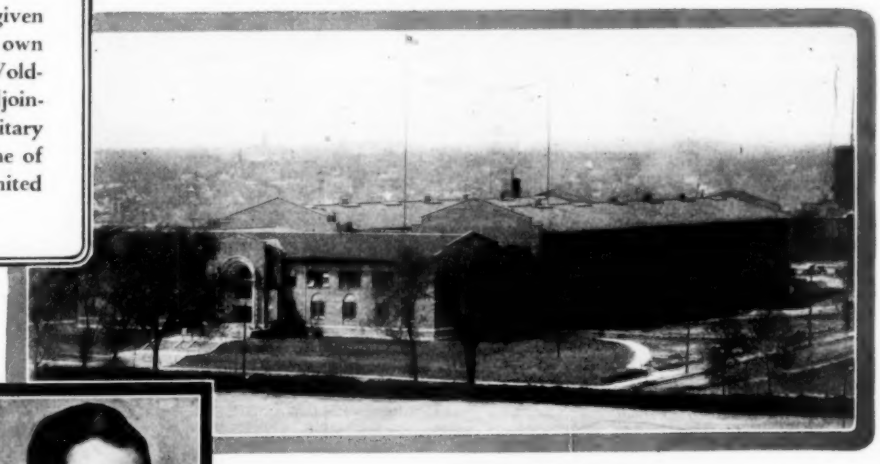

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Airports and Airport Planning

By B. Russell Shaw
Aeronautic Construction Engineer

WITH the coming of air transportation, a need developed for proper air terminals. In the early days of flying in this country, airplanes were launched by means of a catapult comprising a rail which was laid into what little wind was blowing, and the airplane was placed upon a small monorail car consisting of a horizontal timber supported on two double-flanged wheels resting upon the track. The skids of the plane were supported on each end of the horizontal timber. At the rear end of the track, at the starting point, was erected a tower with a pulley at the top. A rope extended from the plane to the forward end of the track, around a pulley at that point, back under the plane, and through pulleys to the top of the tower. At this point, it passed over another pulley and carried a very heavy weight. The airplane itself was held fast to the rear end of the track by two pieces of piano wire. After the engine was started and warmed up, the pilot released a catch, and the plane was pulled forward along the monorail, and took the air just before the end of the track was reached. In order to keep the plane balanced laterally before flying speed was obtained, an assistant would run alongside, holding on to one wing tip until sufficient speed was attained for the pilot to balance the plane by warping the wings. As these early planes were not equipped with wheels, landings were made in a very short space, the plane coming down on the skids, which acted as brakes, and which therefore slowed the plane up very quickly.

A little later on, the dropping weight was abandoned, although the monorail was still used. Following that, wheels were placed on each side of the skids with very flexible rubber shock absorbers so arranged as to allow the skids to scrape along the ground upon the first impact of landing. At the time of this later development, other planes were being built with wheel landing gears. With the addition of wheels to an airplane, there automatically came the increase in length of run necessary for landings and take-offs. In the early planes of the Curtiss type, having two wheels in the rear of the center of gravity and one considerably forward of this point, a steel-hook brake was added between the rear wheels, and this was dug into the ground upon landing to slow up the plane.

The Bleriot monoplane, which was really one of our first tractors, was equipped with two caster wheels, slightly forward of the center of gravity, and a third wheel mounted under the fuselage, just ahead of the horizontal stabilizer. It was impossible to add brakes to this plane because of the position of the two forward wheels with relation to the center of gravity. If friction was applied to the wheels, the plane would somersault forward. The next step was to remove the rear wheel and replace it with a skid constructed of two loops of rattan with sheet-iron shoes underneath. This slowed down the plane upon landing. From that time until recently, the tail skids gradually changed, particularly on the smaller planes, until they formed a knife edge, or drag, and at the same time the front wheels were moved forward with increases in horsepower, thus adding additional weight at the tail when resting on the ground and, consequently, increasing the braking effect of the tail skid. This has been very detrimental to the surface of flying fields, particularly in wet weather, and the present trend is to place brakes on the two front wheels and replace the tail skid with a third wheel.

The foregoing is for the purpose of enlightenment as to the development of the landing gear of an airplane, for primarily an airport is an area of sufficient size with suitable surroundings and equipment to provide the proper facilities for taking off and landing airplanes under all weather conditions.

Airport Development

As airplanes have increased in size and in load-carrying ability, so has it been necessary to increase the size of the airports to accommodate them. At this point it is well to differentiate between commercial air transportation and military aviation. The difference with which we are concerned with respect to commercial airports is that a military airplane sacrifices load-carrying ability for certain other military necessities, such as climb, maneuverability, and speed. In other words, the military craft is not financially concerned with the amount of pay load it can carry per horsepower. On the other hand, a commercial airplane is very much concerned with the amount of pay load it can carry per horsepower. The result is that military planes are designed to carry less load per horsepower than commercial aircraft. It therefore stands that military craft do not need as much space for take-off because of their surplus horsepower, whereas a commercial plane having very little surplus horsepower necessarily requires a greater take-off distance.

In discussing airports the commercial problems entirely will be kept in mind. If these are solved, the operation of military craft from these airports in times of war is automatically covered.

Commercial airline operation requires that each plane carry its full capacity load under any and all weather conditions. This is greatly different from the commercial operation of small planes carrying passengers on short hops.

In the operation of a commercial airline, if a plane will carry fourteen pay passengers and the seats are sold for this number of passengers, the airport from which the airplane operates must be of sufficient size and have the proper surface to allow the plane to take off safely with its entire load. On the other hand, the operator of a small plane may reduce his load, particularly on short flights, without inconveniencing passengers; providing it is necessary to do this because of improper field and weather conditions. Experience shows that a commercial airplane which may normally require 1,000 or 1,500 feet for take-off, may at times require two or even three times this length of run under abnormal conditions, such as hot, muggy weather when the atmospheric density is reduced. Also, the field may be soft, or in the winter time when other conditions may be good the frost may be coming out of the ground or the field may be covered with snow. In any of these events, the airport must be of sufficient size to allow the airline operator to take

*Contributed by the Aeronautic Division for presentation at the Summer Meeting, St. Paul-Minneapolis, Minn., August 27 to 30, 1928, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 29 West 39th St., New York, N. Y. All papers are subject to revision.

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The American Society for Promotion of Aviation was organized by 12 ex-service aviators at the Army & Navy Club, New York City, in 1925. It is a voluntary non-profit organization incorporated and maintained

¶ To "Arouse and promote interest in aviation, as our strongest army of National Defense."

To make America air-minded—to cooperate with air-craft manufacturers in building up this newest industry—

To organize civilian flying clubs throughout this country and to help train pilots for national emergencies.

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off with his full load on a definite schedule.

Small planes may be easily handled in side winds, but large airliners should take off and land as nearly as possible directly into the wind. This makes it necessary for an airport to be designed to allow take-offs and landings from all directions.

Landing Surfaces

The proper surface for an airport has received a great amount of attention and criticism. There are those who argue that sod is the best, others advocate cinders, gravel, crushed rock, or iron slag. The latest surface to be used is concrete. An airplane when rolling slowly on the ground may be treated as any other vehicle of similar weight presenting to the surface of the ground the flattened area of the tires. The surface must be sufficiently hard to withstand this weight under all conditions, and the author will touch upon some of the advantages and disadvantages of the various types of surfacing just mentioned.

Grass or sod comes first, as it is the natural result of a properly maintained piece of ground. In dry weather, or even in moderately wet weather, a good sod with an adequate system of sub-surface drainage is quite satisfactory. In very wet weather, or in the spring when the frost is coming out of the ground, the surface condition is very bad, despite the fact that there is a heavy growth of grass. Wheels and tail skids of planes will cut deeply into the sod, causing furrows which are very injurious to landing gears; and therefore to the plane in general. In many instances where these furrows or ridges have frozen overnight, planes have been wrecked or wheels torn off or broken by becoming caught in the furrows when taxiing or taking off.

Cinders provide the next and seemingly best alternative to sod. They are dry even in wet weather, and may be easily underdrained. Cinders produce a sort of capillary action, so that when they are placed on loam or clay soils it will be found that the soil gradually works to the top and the cinders eventually disappear. One of the greatest drawback to cinders is the ease with which they are torn up by tail skids and picked up by the propellers, resulting in much damage to the tips of the blades and the sides of the fuselage and tail surfaces.

Gravel and *crushed rock* have been tried. Gravel is naturally ball-bearing in its action while crushed rock on the other hand keys itself together and is not so easily disturbed. Each of these, however, must have some type of binder to hold it in place. Clay cannot be used because it will wash away in rainy weather. Attempts have been made to treat the gravel or crushed rock with a bituminous compound, but when this is done we begin to approach a waterproof surface which, when constructed without sufficient base, easily breaks through; therefore it is necessary to build such a runway in the same manner as a macadam road. Disadvantages of this surface are the ease with which it may be cut by tail skids in landing and the fact that it is quite slippery in wet weather. Both gravel and crushed rock are easily picked up by the propellers, resulting in the same type of damage or even worse than that experienced with cinders.

Iron slag has been tried, but conditions similar to those accompanying the use of crushed rock are encountered.

If you wish to secure a position in the aeronautical industry read the "Clearing House for Aviation" on page 98 of this issue of Popular Aviation.

Concrete is now being installed at the Ford Airport at Detroit as the first real experiment with this type of surfacing. Concrete presents a surface not easily scratched by tail skids and is not slippery in wet weather; however, the cost is almost prohibitive, except upon large municipal airports handling a considerable amount of traffic.

With the return of three-wheel landing gears, it is becoming even more practical than before to use hard-surfaced runways. Planes not equipped with the third wheel may land on the grass near the runways.

Summing up the foregoing, it appears that on flying fields and airports having a relatively small amount of traffic, sod should be used with a very careful and extensive sub-surface drainage system. The only alternative to sod, in the author's estimation, is concrete, and this is justified on very large airports only.

Drainage

The use of hard-surfaced, waterproof runways also necessitates very complete drainage systems paralleling the sides of such runways. These drainage systems must be of such character as to readily and quickly handle the run-off of water falling on the runways, in order to keep the sod at their edges from becoming soggy, which would result in serious damage to planes should they run off the hard surface during a take-off or landing. The concrete runways at Ford Airport are proving beyond a question of a doubt that this is the most practical and logical solution to our problem in so far as we are acquainted with it at this stage of aviation development.

Catapults and Brakes

It is the author's prediction that later on, if our present design of airplanes continues, that is, no radical departures which do not at present seem possible, some system of catapult for the starting of planes will be used. This of course would not be as severe and abrupt as that now in use in the Navy; and a special type of arresting gear or very effective brakes would slow up the landings. In this way, it may be possible in the future to reduce the size of the field required.

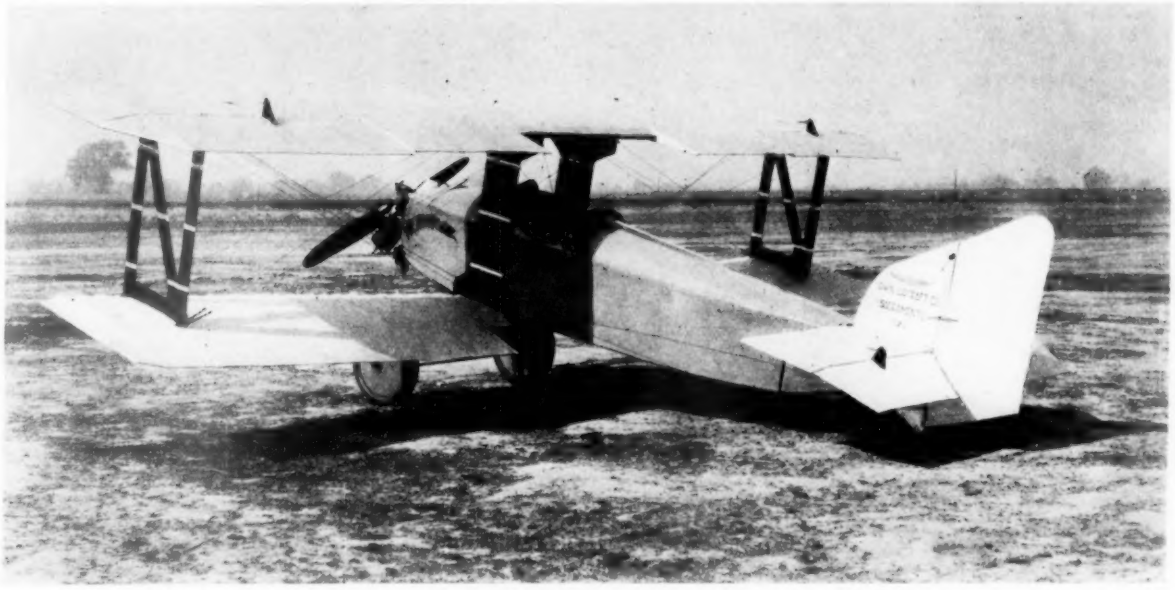
Terminal Facilities

Commercial airline operation requires proper terminal facilities, not only with respect to the field area itself, but also to the proper accommodations afforded passengers in the way of terminal buildings, passenger depots, etc. Passengers must not be allowed to ramble about on a flying field, for this is particularly dangerous, to say nothing of being an uncomfortable and careless method of handling travelers. Terminal buildings must be erected at our principal airports so that airplanes may be brought under cover before departure and after arrival. In this way, passengers may be handled with dispatch and without inconvenience to them.

Air travel is primarily one of speed. It is foolish to save an hour or so traveling between certain cities and then lose the time thus saved in transportation from the airport to the city of destination. At the present stage of development, with the large acreage needed as well as suitable surroundings and an absence of obstructions, the airport must be located away from the built-up section of the city, or additional acreage must be provided to make surrounding obstructions of no consequence. The ultimate airport will undoubtedly be constructed over the downtown section of the large city; however, with the areas necessary at present for take-offs and landings, such a structure would represent an

(*Continued on page* 117)

Index of American Aircraft



The Meteorplane

A one-seater tractor biplane designed for sport flying by Irwin Aircraft Co.; manufactured by Irwin Aircraft Co., Sacramento, Calif.

Specifications

General

Type	Tractor—Open
Use	Sport
Length	14 ft.
Height	67 in.
Span	20 ft.
Chord	3 ft.
Place	1
Control	Single—Stick

Power

Type	Radial X
Make	Irwin
Rated H. P.	20
Cooling	Air
R.P.M.	1,750

Wing Data

Curve	Irwin No. 4
Sweepback	None
Dihedral, Upper Wing	3°
Spread	20 ft.

Areas

Planes	105 sq. ft.
Ailerons	Two—Not Balanced

Weight

Weight empty	250 lbs.
Fuel	40 lbs.
Useful load	300 lbs.
Pay load	100 lbs.
Pounds per H.P.	28

Performance

Loading	28 lbs. per H.P.
High speed	90 M.P.H.
Cruising speed	75 M.P.H.
Climb in first min. (loaded)	500 ft.
Service ceiling	12,000 ft.
Fuel capacity	4 hrs.
Cruising range	300 miles
Landing speed (sea level)	26 M.P.H.

This page, and the other side, is the eighth of a complete series that it will pay you to save in a loose-leaf binder. Every month POPULAR AVIATION will publish the specifications of different aircraft in a standard form, and the entire series, when kept up to date, will afford you a master index of the types and makes of aircraft in the United States. The selection printed every month is chosen at random by POPULAR AVIATION and no attempt is made to publish the specifications in any order, alphabetical or otherwise.

Index of American Aircraft

The Stearman Biplane C2B

A three-seat open-type biplane designed and built by the Stearman Aircraft Company, Wichita, Kan.

Specifications

General

Type	Open Biplane
Use	General
Length, over all	24 ft.
Height, over all	9 ft.
Span, upper wing	35 ft.
Span, lower wing	28 ft.
Crew	One
Passengers	Two
Control	Stick

Power

Type	Wright-J-5AB
Rated Horsepower	200
Cooling	Air
R. P. M.	1800
Power Loading	12.25 lbs. per H. P.

Wing Data

Sweepback	None
Dihedral	None
Wing Loading	8.25 lbs. per sq. ft.

Weight

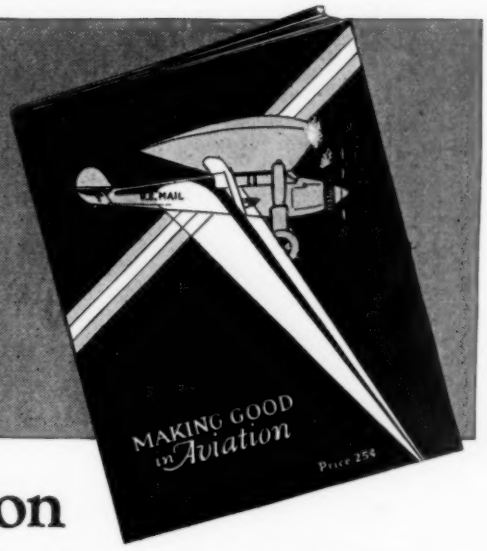
Weight, empty	1600 lbs.
Useful Load (less fuel and oil)	500 lbs.
Normal Weight, full loaded	2450 lbs.

Performance

Cruising Speed	110 m.p.h.
Landing Speed	41 m.p.h.
Service Ceiling	18,000 ft.
Climb, per minute	1100 ft.

This page is the eighth of a complete series covering aircraft manufactured in the United States. Every month POPULAR AVIATION will publish the specifications of different aircraft in a standard form, and the entire series will afford you a master reference guide of the types and makes of aircraft in the United States. The selection printed every month is chosen at random by POPULAR AVIATION and no attempt is made to publish the specifications in any order, alphabetical or otherwise.

Read This Inspiring Book



Making Good In Aviation

is the title of our vitally interesting new illustrated book, filled from cover to cover with valuable suggestions for young men who hope to become flyers "some day".

Tells you of the present opportunities in aviation—the future possibilities—types of position open—what these positions pay—how to fit yourself for them.

In this book you will read the stirring story of the days

When "Slim" Flew the Mails

One of the most thrilling chapters in the life of Col. Chas. A. Lindbergh deals with his activities as our Chief Air Mail Pilot and Instructor—when he helped young men to the realization of their ambitions—when he laid plans for his own epoch-making flight—when he shared adventures with his fellow pilot, "Bud" Gurney, former barnstormer, who later succeeded Col. Lindbergh as our Chief Air Mail Pilot and Instructor.

Our new book is dedicated to Col. Lindbergh and contains a full-page photograph of this gallant flyer, which you will be proud to frame. Also photographs of many types of aircraft and scenes at huge modern airport. Book tells how an up-to-date flying school is conducted; how airplane mechanics get their training.

Don't fail to send for this valuable book—only 25 cents, stamps or coin.

Col. Lindbergh visits his former fellow-worker, "Bud" Gurney, who succeeded him as Chief Air Mail Pilot and Instructor at Robertson's. Photo from "MAKING GOOD IN AVIATION."

Air Mail Pilots Teach You to Fly

at Robertson School of Aviation. "Bud" Gurney and other active Air Mail Pilots (Chicago-St. Louis flyers) instruct and check advanced students. No other school offers this advantage. Ten licensed Transport Pilots are on teaching staff, using system taught at Army Flying Schools.

Robertson School of Aviation is one of the oldest, largest, best equipped and most favorably known in the country. Founded and conducted by army aviators, has record of 9½ years—hundreds of graduates—*no accidents.*

Training in modern ships of several types—all Government licensed and inspected. Marvelous field of 700 acres. Mahoney "Ryans" and Curtiss "Robins" manufactured right here. Huge 12-passenger Ford Tri-motor Planes in everyday service—complete National Guard Air Unit—125 men, 10 ships. Something stirring every moment. Year 'round flying in St. Louis.

Advanced students at Robertson wearing Army Type Parachutes, about to take flight in fast mail plane. Photo (greatly reduced) from book: "MAKING GOOD IN AVIATION"

Robertson Flying Services, Inc.

Department L

Affiliated with Robertson Aircraft Corporation

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Lambert-St. Louis Airport

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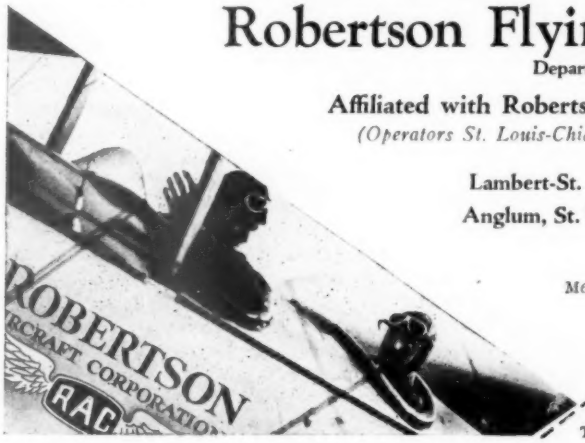

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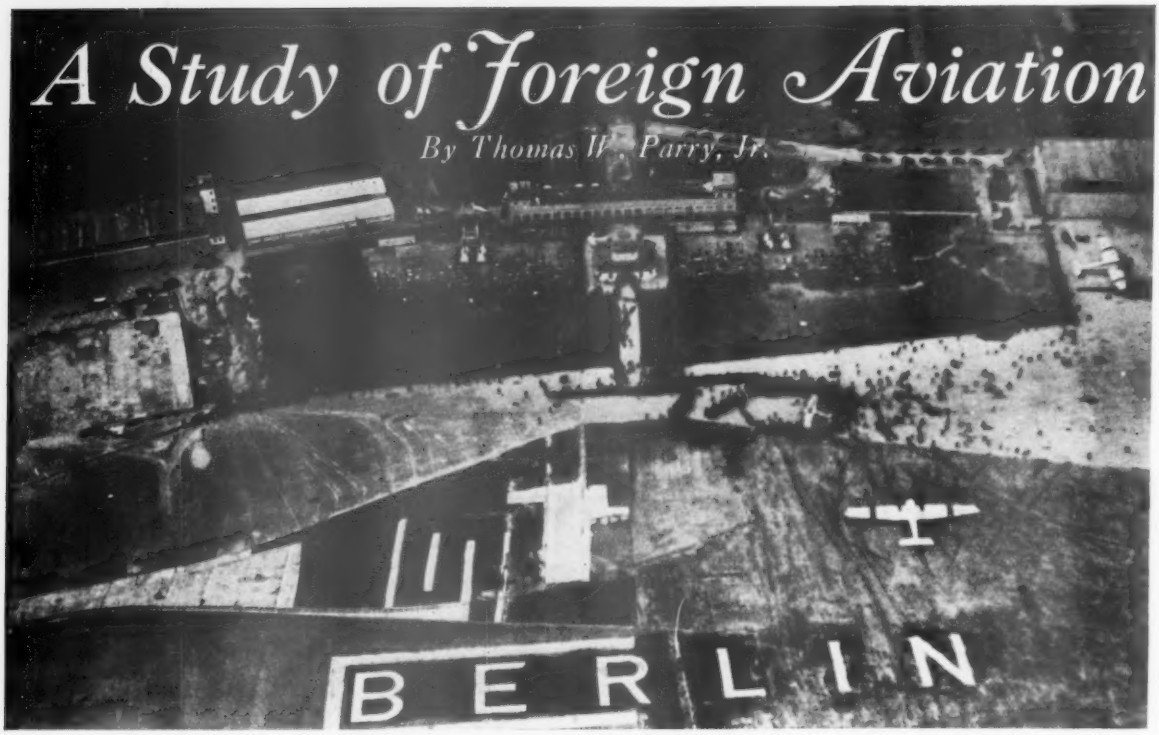
A Study of Foreign Aviation

By Thomas W. Parry, Jr.



Templehof Air Field near Berlin, Germany.

WHAT is said to be the first comprehensive study of foreign aviation developments conducted by an American city has been completed by the Air Board of the St. Louis Chamber of Commerce. Those who participated in it are confident they will establish their city as the aeronautical capital of America, and they believe that the European aviation achievements of which they learned will be invaluable in the project of converting Lambert-St. Louis Field into a model $2,000,000 municipal airport. Bonds for construction of the airport were voted by a majority of more than five to one at a recent election.

More than one hundred St. Louisans participated in the foreign aviation study sponsored by the Air Board. The purpose of the trip, which carried the delegates into France, Belgium, Germany, Italy, Switzerland, Holland and England, was to learn of the aviation developments in European cities with a view to applying locally some of the outstanding ones. The delegation left St. Louis June 20.

When he confers with members of the Air Board this fall, Harold M. Bixby, chairman of the board of Directors of the Chamber of Commerce and one of Lindbergh's chief backers, will make several pertinent recommendations for the equipping of St. Louis' municipal airport, based on his findings during a 2,500-mile airplane journey over thirteen European nations. He believes that:

1. Neon lights should be used to illuminate the field. From his observations at leading foreign airdromes, he said, neon appears best suited for lighting the fields, because it produces a soft light which is readily distinguishable from other lights, and because experience has shown that neon lights are capable of penetrating mild fogs. He is substantiated in his conclusions by Stanley Clarke, chairman of the Air Board, who also participated in the 2,500-mile aerial trip.

2. A concrete apron, extending the length of the field, and warping to width of at least 350 feet at its widest section, should be constructed in front of the hangars. Such a strip, he pointed out, has been laid at Tempelhof Airdrome in Berlin, and extends for a length of 2,000 feet in front of all hangars and administration buildings. Airplanes arriving at the field taxi onto the concrete apron to release their passengers. In this manner, Bixby said, dust is reduced to a minimum.

3. While no European fields have runways, airports in the United States must be provided with them. They should be constructed of a semi-hard material, such as cinders, and should extend a considerable distance in each direction. The turf on foreign fields is generally in such good condition that runways are superfluous.

4. A waiting room with telephone and telegraph facilities should be provided for passengers and pilots, and restaurants should be installed.

5. Airplanes should be equipped with radio, maintaining constant communication with their home airports, as well as other airports along the route.

6. Accurate weather reports, which have been lacking at many American airports, should be available at all times.

"All of these improvements," Bixby said, "as well as others which have been outlined, can be made for $2,000,000. Although the United States is ahead of Europe in development of the air mail, we have not scratched the surface in airplane passenger service.

"Since commercial aviation is not subsidized by the government in the United States, our future air transport lines, in order to pay, must use larger and faster planes than those utilized in Europe. While many four-passenger planes are in foreign passenger service, I doubt if one of less than twelve-passenger capacity would pay in America.

"Tempelhof Airdrome at Berlin is

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your engine temperature (oil or water or both), it visualizes the performance of your motor.

Reads from 32 to 212 degrees, 2″ black dial, 10′ lead, complete, ready to mount flush to dashboard.

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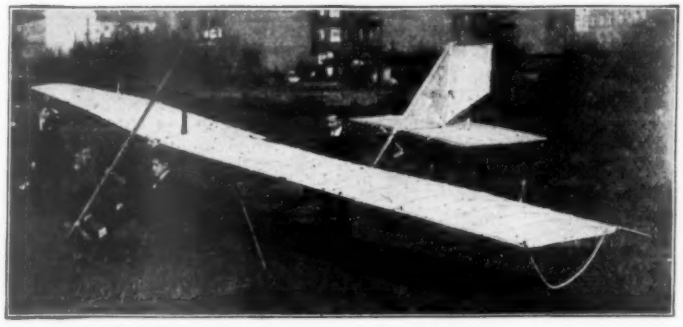

The world has sat in wonder at the tremendous feats performed in Germany in gliding. Already, gliders have remained aloft without power for 14 hours—a marvelous achievement.

Here is a sport for American youth, new—thrilling—exciting. Every boy in America should take up the sport of gliding. It keeps you out in the open. It starts you on the road toward aviation.

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Here is a chance for you to get started on gliding, easily—safely—economically. We will furnish you complete blue prints on a glider—one of the most successful ever flown—one that is guaranteed. Together with these blue prints, comes a booklet giving complete instructions on construction and on the art of gliding. As an introductory offer, we will make a very special price in order to start American youth in this new sport. Easy to build, simple to fly, any boy can do it. Complete blue prints and instruction manual for only **$5.00**

GOTHA GLIDER COMPANY

3217 W. 64th Place
Chicago, Illinois

far and away ahead of all the others we visted in equipment and general layout, although those at Paris, London, Amsterdam and Brussels are quite adequate. It is at Tempelhof that red neon light have proved so effective. The neon tubes are six feet in length and are placed about the field at fifteen-foot intervals. In addition, Tempelhof is equipped adequately with flood and beacon lights.

"Before commercial aviation in the United States can be placed on a par with that in Europe a uniform air code is essential. At present various states require that planes be marked in different places, while in Europe all passenger planes have common markings and regulations. The sixteen passenger air lines in Europe have formed an association which has played a prominent part in the advancement of aviation abroad.

"One of the regulations which the association enforces is that requiring planes to pass on the right. While such a regulation appears rather superfluous to the layman, it is an excellent precaution in the case of three planes meeting. The association has also effected an agreement whereby pilots are not required to have a permit in flying their planes from one nation to another.

"One of the principal disadvantages in foreign air travel is the lack of information for passengers. Interest in the trip would be enhanced if the pilot could supply travelers with information concerning the country over which the plane is flying. A system might be devised whereby the pilot could jot down bits of information to be automatically transmitted to a pad in front of the passenger.

Walter B. Weisenburger, president of the St. Louis Chamber of Commerce.

"There is no doubt in my mind that commercial aviation has figured largely in cementing friendship between European countries. Europe is not only making strides in passenger aviation, but in airplane express service as well. Some time ago express service was inaugurated between Paris and London with one plane being used. The service proved so popular, however, that three planes are now being used. They leave Paris at 5 o'clock every morning, and the merchandise they carry to London is delivered in time for morning sales. Small repair parts and fine laces are the principal commodities transported in this manner. A similar service between St. Louis and Dallas, Tex., which has been discussed, might be utilized advantageously by oil operators who required repair parts from St. Louis factories."

Bixby and Clarke averaged approximately 100 miles an hour during their flight, covering more than 2,500 miles in 25 hours and 35 minutes flying time. They left LeBourget Field on the outskirts of Paris the morning of July 7 and arrived at Croydon Field near London the evening of July 13. With but one exception each leg of their journey was started and concluded on time, and in many instances they arrived at their destination ahead of time.

From LeBourget they flew to Zurich, Berlin, Koenigsburg, Riga, Reval, Helsingfors and Stockholm. From the latter city they traveled by rail to Malmo and from there flew to Copenhagen, Hamburg, Amsterdam, Rotterdam and London.

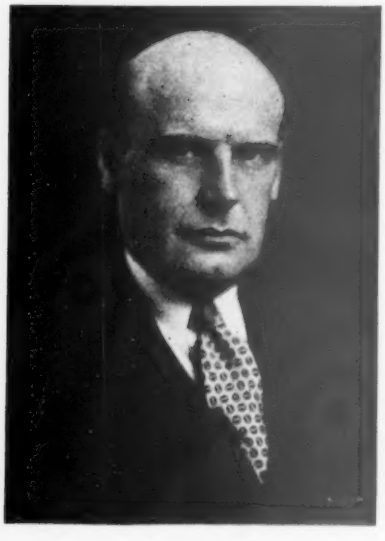
"European air lines are operated with the precision of trains," Clarke said. "The great distances from large American cities to their airports is one of the greatest disadvantages of commercial aviation in our country. While the same is true in London and Paris, where an hour is required to reach the airdromes, one may arrive at Tempelhof from Berlin in ten minutes by subway.

"In my opinion air travel is more necessary in the United States than in Europe, because of the great distances between cities. While its development may not be as rapid as it has been abroad, airplane travel in the United States will eventually be comparable in a degree to rail travel."

Low rates contribute largely to the popularity of airplane travel in Europe. The fare from London to Paris, a distance of 230 miles, is $25, only $5 more than first-class rail rates.

Arriving in Cherbourg, France, July 1 the one hundred odd Air Board delegates departed directly for Paris, remaining there until July 7. During their visits on the continent and in England the St.

Stanley Clarke, chairman of the Air Board of the St. Louis Chamber of Commerce.



Harold M. Bixby, Chairman of the Board of Directors of the St. Louis Chamber of Commerce.

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The short cut to a knowledge of flying

128 pages

Takes all the mystery out of aviation

40 illustrations

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Louisans were cordially received by government and civic leaders. In addition to their aviation study they participated in various sightseeing trips.

On July 2 they took part in a 250-mile tour of the World War battlefields, inspected a German trench, saw the Rheims Cathedral and the shell-riddled villages about Paris. Many of the delegates, on July 4, attended the ceremonies attendant to the unveiling of the monument to the Lafayette Escadrille at St. Cloud, eleven miles from Paris. Sixty-seven American aviators, members of the outfit, were killed while fighting under the flag of France before America's entry in the War.

That afternoon they attended a reception at the United States Embassy, where Bixby, Walter B. Weisenburger, president of the St. Louis Chamber of Commerce, and Carl F. G. Meyer, vice-chairman of the Research and Survey Committee of the Air Board, presented Ambassador Herrick with a silver replica of the medal given Lindbergh by St. Louis after his Paris flight. That evening twenty St. Louis men attended the annual Independence Day banquet of the American Chamber of Commerce in France.

Before Bixby and Clarke left on their air tour, the St. Louis party, after inspecting LeBourget Field, conducted a brief ceremony at the monument erected on the field in honor of Nungesser and Coli and Lindbergh. Misses Frances C. and Elizabeth M. Bixby, 10 and 12 years old, daughter of Mr. and Mrs. Bixby, placed a wreath at the foot of the monument as a tribute to the French aviators who lost their lives in an attempt to span the Atlantic, and a spray of flowers in honor of the first airman to accomplish a New York-to-Paris flight.

During their visits in Brussels, Amsterdam, London and Berlin the delegates inspected airports and airways and presented several Lindbergh medals to foreign dignitaries. After the Paris visit the delegation split up, half of the members going into Germany and Italy. Many of them have returned to St. Louis, while others will remain abroad until early fall.

Many of the recommendations which Bixby made for the improvement of Lambert-St. Louis Field are incorporated in the city's plans for that municipal airport. Four hard-surfaced runways, 4,500 feet long and 200 feet wide, are to be constructed, a tentative sum of $835,000 having been allotted for runways,

Carl F. G. Meyer, vice-chairman of Research and Survey Committee of the Air Board, St. Louis Chamber of Commerce.

ditches, grading and drainage. Connecting the ends of all runways will be a concrete taxi strip, so that planes taking off and landing may reach the runways by rolling over a hard surface, thereby preventing miring or cutting up of the field even with the heaviest craft and under the softest field conditions.

When completed the airport will be the equal of any airdrome now in use in Europe and of those now under construction in Detroit, Chicago and Kansas City. Incorporated in the passenger terminal building, according to bond issue plans, will be a midway tunnel of the latest development through which planes will pass to take on and discharge passengers. The span of the midway is planned to be 200 feet wide, sufficient to accommodate the largest multi-motored craft which are now being constructed abroad.

Executive offices will be in the terminal building. An inside restaurant and lunch counter, and a roof garden on top of the midway, upon which spectators and friends of passengers may be served light refreshments, have been planned. Baggage, express and mail rooms also are incorporated in the general design for the terminal building. Near the building will be large hangars for air line operators and others using large equipment. Two large hangars with open sides and four smaller ones having 150-foot openings have been planned.

The lighting system will cover the entire field. A comprehensive system of field and boundary lights, operated from a control building, will be installed. Takeoff lights will form a unique system of stop and go signals, and will be operated by a plane dispatcher. During the daytime lights will be supplemented by numbers on the roof of the dispatcher's office.

A tentative budget for expenditures under the $2,000,000 St. Louis Airport bond issue follows:

Land, 693 acres	$ 485,000
Buildings	438,000
Rolling stock, including automobiles, tractors, field cars, etc.	20,000
Roads	90,000
Water installations	15,000
Lighting system	10,000
Runways, ditches, grading and drainage	835,000
Surveying	3,000
Total	$1,896,000

Mexican Air Mail

Expense of establishing new air mail routes in Mexico will be paid for by a sum of 1,200,000 pesos or about $570,000 to be collected this year from increased postal rates on first class matter, reports Acting Commercial Attache George Wythe, Mexico City, to the Department of Commerce.

Establishment of three air routes are reported planned on: (1) To connect Mexico City with air mail service of the United States at some Texas port; (2) from Monterrey via Torreon to Mazatlan; and (3) from Mexico City to Vera Cruz, Puerto Mexico, Frontera, Campeche, and Merida. The northern route has not been definitely decided upon, but it appears probable that it will pass via Queretaro, San Luis Potosi, and Monterrey. It is still uncertain whether the route will continue from Monterrey to Nuevo Laredo, connecting with the United States air service at Laredo, Texas, or will go to Tampico, connecting with the United States air service at Brownsville, Texas.

Advertising Notice

We wish to call attention of our readers to an error in printing the price of one of the radiator ornaments advertised by Ancient Art Metal Co., Inc., on page 78 of our September issue. The price of the second article is $1.50 instead of $3.50.

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Aviation needs young men. But it does not want thrill seekers or fellows merely looking for a new and more attractive playground. There is no room for you unless you come to aviation prepared to qualify yourself for some phase of the important development work which must be done in the coming years.

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In a dozen types of service.

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Repairman, Rigger, Motor Expert, etc.

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A dozen types of highly skilled workmanship in airplane construction.

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Design, Construction, Management and several phases of operation.

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The airplane is sold and serviced just like the automobile. A wonderful field for the man who knows flying.

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If you are attracted to Aviation because you are seeking an opportunity to grow with the industry . . . and to help it grow, the Porterfield Flying School has an important message for you. Aviation will exceed your fondest expectations. It will offer a field for development limited only by your own ability and desire to succeed.

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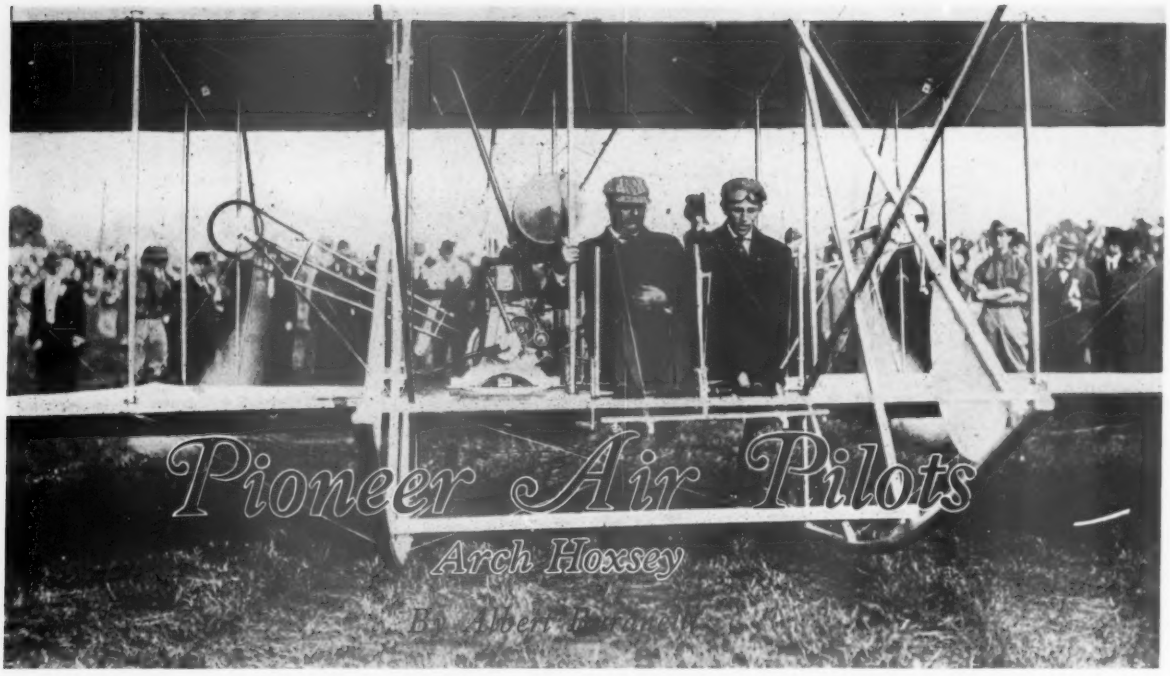

Ex-President Roosevelt and Arch Hoxsey at St. Louis.

THE Heavenly Twins!

How few are they who can recall the significance of that appellation; yet the men designated by it were stars of the first magnitude in their day. Hoxsey and Johnstone. Their names, linked by their friendly rivalry for the altitude crown, were drawing cards at any meet. As one in their skill and daring; otherwise they were as apart as the poles: big, bluff, careless Johnstone and dapper, amiable, careful Hoxsey.

Irish, French and German blood flowed in the veins of Hoxsey. He was born in the little town of Staunton, Illinois, on the 27th of October, 1884. He was an only child. His father died when he was seven years old, and his mother brought him to California in the following year. She made a home in beautiful Pasadena. There Hoxsey spent his youth.

Though of a calm, equable temperament by nature there was a sure method of puncturing his tranquillity: saddled at birth with the name of Archibald, he had conceived a violent antipathy for it; Arch was sufficient for him, and Arch he was to those who wanted to avoid quarreling with him. Otherwise he was peaceably inclined. He was a dutiful son, and his mother idolized him. Acting on her suggestion he became a machinist. It was soon evident that he had a flair for things mechanical.

Not the least noteworthy event of the opening years of the twentieth century was the arrival of a new fangled contraption that few people could see anything in: the automobile. The best of them had a pernicious habit of honking out at the most inopportune times. It was the day of the "Git a horse" slogan.

One of the first to acquire an automobile in Hoxsey's home town was M. D. Martin, son-in-law of John W. Gates, the well known Chicago financier. He had his difficulties with it, and finally he discovered to his great disgust that there was something radically wrong with the engine. His chauffeur could not locate the trouble, and the various motor experts he called in failed also.

Hoxsey, listening to their vague surmises regarding the trouble, asked for an opportunity to inspect the engine. That evening after his regular work, he went to the garage and set to work. It required the better part of the night to make the necessary repairs; but the motor was functioning as well as it ever had when he finished.

Very much pleased Mr. Martin made Hoxsey an offer that he could not very well refuse. Shortly after taking his new position his employer's brother-in-law, Charles W. Gates, arrived on a visit. He was contemplating a transcontinental trip by automobile; a considerable undertaking at that time. A few rides with Hoxsey at the wheel impressed him. Here was the ideal companion for a cross country trip. Gates persuaded his brother-in-law to relinquish the services of Hoxsey, and hired him instead.

It was a fortunate connection for Hoxsey, even though the transcontinental trip did not materialize. During their association—a period of some four or five years—they toured Europe, and many sections of this country as well. That Hoxsey's interest in aviation was not of the up-overnight variety is evidenced by the fact that he discussed the subject on many occasions with Gates, and even confided to him his ambition to fly. Shortly before Christmas in 1909 he was at Port Arthur, Texas. A six weeks' vacation permitted him to return home for the holidays.

At Dominguez Field, Los Angeles, the first flying meet ever held in this country took place during January, 1910, with such stars as Curtiss, Paulhan, Hamilton and Latham participating; Lincoln Beachey was also there, but as skipper to Capt. Baldwin's "California Arrow." The sluggishly moving dirigibles—there were two or three at the meet—provided an excellent contrast for the airplanes as they sped overhead, and Hoxsey determined that he would fly.

With his resolution to become an aviator thus crystallized, Hoxsey

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confided his ambition to his mother. He had always been somewhat of a fatalist, and she had absorbed his theories. Besides she had the greatest confidence in his ability to take care of himself. She raised no objections.

Hoxsey's vacation period was almost up, and he started for New York City where he was to meet his employer. However, he arranged for a stopover at Dayton, Ohio. He called on the Wrights and confided to them his eager desire to fly. They refused to sell him a machine outright; and to the suggestion that he be permitted to become a member of the coterie of exhibition pilots they were gathering they were non-committal. He left, after a three day visit, without coming to a definite understanding; but, although he was unaware of it, his frank unassuming manner had decided the issue.

Shortly after his arrival in New York he received a telegram offering him an opportunity to join the exhibition team. Within twenty-four hours he resigned his job, arranged other necessary matters, and was on his way to Birmingham, Alabama, where he was to meet Orville Wright. The aviation school was at Montgomery, and they continued thither. There he met Walter Brookins, first pupil of the Wright Brothers, who coached him in the intricacies of navigating the air. There also he met the man whose name was fated to be linked to his: Ralph Johnstone.

That he was an apt pupil was proven at his first public appearance during the course of the meet at Asbury Park, N. J. He was a popular idol with the crowds from the start. This perhaps was accentuated by his costume. He always appeared dressed in a spotlessly clean yachting suit which attracted much favorable attention among the girls. The summer throngs watching Hoxsey fly high over the boardwalk would cry:

"There goes the aviator with the ice cream trousers."

His spick and span appearance on all occasions was a constant wonder to those who knew him. When asked how he managed to keep his clothes so spotless he confessed that it was a habit with him.

"For six years," he said, "I have not worn overalls when working around an oily motor, and I can't recall ever having spotted my clothing."

As he was in his personal habits, so he was in regard to his airplane. Previous to making his flights he would have his mechanic dust off the wings in order that his ship would have a neat appearance. Before going on a flight he never failed to make a close inspection of every part of his machine. He would not ascend until he was assured that it was perfectly safe; and he would not hesitate to spend a half an hour or even longer testing every wire and screw in order to satisfy himself that such was the case. That a machine handled with such meticulous nicety should fail at all is an impressive illustration of the dangers that beset the paths of the early pilots.

Following the Asbury Park meet the Wright exhibition pilots began

a tour of the middle west. Hoxsey met with his first mishap while flying at Lincoln, Nebraska, on the 5th of September. Something went wrong at a low altitude, and, being unable, under the circumstances, to choose a more suitable landing place, he set his machine down on the peaked roof of a barn. He was thrown out, and he went tumbling down one side of the structure; the plane, fortunately, slid down the other side. Hoxsey's injuries were slight, but the plane was a washout.

The New York World and the St. Louis Post Despatch about this time offered a prize of thirty thousand dollars for the first flight between the two cities, and Hoxsey fixed his eye on the rich plum. The Wrights, however, to whom he was bound by contract, frowned on the project.

Skillful management on Hoxsey's part prevented a catastrophe on the 16th of September. He was flying at the Wisconsin State Fair at Milwaukee. The weather had been bad throughout the day, and it was not until late in the afternoon that he ordered his machine from its shelter. The takeoff was complicated by the fact that the wind was from the south. It forced him to rise with the grandstand in front of him. A mishap at the wrong moment would precipitate him into the crowd.

The plane was wheeled to the northern end of the enclosure, and Hoxsey took his seat. Bobbing and swaying as the gusts tore at it the plane lifted from the ground; it gained height slowly, but steadily.

The plane neared the grandstand; it wavered as a sudden gust hit it; it veered to the right. Hoxsey, realizing the danger, immediately turned downward; but before he could stop it the plane had dashed into the crowd. Two women were painfully injured, and a number of the spectators were bruised in the rush that ensued when the accident was seen to be unpreventable. Hoxsey jumped from his seat and went to the assistance of the injured.

Because of his propensity for taking chances Hoxsey missed an opportunity of making a cross country flight from Chicago to Springfield, Illinois. He wrote Orville Wright a letter of explanation which, evidently was sufficient to bring him back into grace. At any rate, he took off from Springfield at 11:56 A. M. on the 8th of October bound for St. Louis. Enroute he made an eighteen mile detour that carried him over his birthplace. A little before three o'clock he appeared over the grounds of the St. Louis Country Club, and dropped down to find out where he was; he then took off and at 3:35 P. M. landed at Kinloch Park.

During his short career Hoxsey carried many prominent people in his plane. The "Big Stick" of them all was the "Big Stick" himself, ex-President Roosevelt. He arrived at Kinloch Field at the head of a cavalcade of fifty automobiles on October 11th. When Hoxsey was told of his presence he approached the Colonel and with a smile invited him to take a ride. After a few moments' conversation the Colonel consented.

Colonel Roosevelt replaced his tall hat with a cap, buttoned up his coat and climbed into his seat, his face beaming with smiles. The moment that Hoxsey wished for had arrived; but the motor was balky.

"I have been down in a submarine, and they seemed to sink more quickly than these machines rise," remarked the Colonel to a spectator. The roar of the engine answered him. The crowd cheered continuously.

Two circuits of the course were made, and, as they approached the

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crowd, the Colonel waved his hat and bowed in all directions, as he was wont to do when riding in an automobile through a welcoming throng. The crowd went wild. After three and a half minutes in the air Hoxsey landed. Upon reaching the ground Colonel Roosevelt grasped the pilot vigorously by the hand, and said:

"It was great. It was the finest experience I ever had. I wish I could stay up for an hour, but I haven't time this afternoon."

"Did you feel scary?" he was asked.

"Not a bit; not a bit. It was perfectly fine. I enjoyed every minute of it."

Hoxsey was more than gratified with the opportunity he had been afforded. After the flight he said:

"The Colonel's birthday and my birthday are on the same date, October 27th, which has always given me a partial feeling toward him. I was determined to take him up with me."

Hoxsey and Johnstone were already engaged in friendly rivalry; each seeking to outdo the other. It was at the International Aviation Meet at Belmont Park that they acquired the joint title: The Heavenly Twins. They well deserved it.

Flying backward is not common today; then—well, it was regarded as a sure method of suicide. It is simple enough in theory: if you are making sixty miles an hour air speed, and are bucking a seventy mile an hour wind your forward ground speed is nothing minus ten. In other words you are traveling away from your destination instead of toward it, and you are doing it tail first. As long as you maintain your position into the wind you are all right; but that position is maintained only by constant vigilance; relax for an instant, make a slight error of judgment that places you at the mercy of the gale, and you are gone.

On the 27th, Hoxsey's birthday, the "twins" took off at 1:30 P. M. There was a twenty-six mile an hour wind on the ground; at three thousand feet it had increased to seventy miles an hour. For almost three hours they fought the wind. At 4:30 P. M. Hoxsey telephoned that he was down at Brentwood, twenty-two miles from the field; Johnstone landed at Middle Island, forty miles away.

"I never had an aeroplane back off with me the way that one did this afternoon," Hoxsey commented that night, "and I never had the blame thing drop out from under me the way that one did. If I went out of my seat once, I'll bet I went out of it twelve times, and then every time, bing! Up she'd come again. From the minute I left the field until I came down in Mrs. Somebody's pumpkin patch I was faced dead against that wind, plowing right into it as hard as the engine would go."

General Felix Angus, of the Baltimore American and Star, offered a twenty-five hundred dollar prize for an altitude flight of ten thousand feet during the course of the meet held at Halethorpe Field. Hoxsey tried for it with a Baby Wright on November 9th. Instead of making the customary circuit of the course, as was generally done at the exhibition meets, Hoxsey tilted his plane upward in a climbing spiral.

John B. May, new Chief Clerk of the Bureau of Aeronautics, Navy Department.

Five minutes later he was at two thousand feet, and he had reached fifty-three hundred feet when the spectators saw him dip downward in a rapid glide. He disappeared from view behind a clump of trees.

A few minutes later Hubert Latham, returning from a cross country hop, told the meet officials to send assistance to Hoxsey, as he had seen his plane lying upside down in a field. When the field ambulance arrived Hoxsey was found in a dazed condition standing beside the wreck.

At his greatest altitude, he explained, the engine "got hot and jammed." Forced to descend he made no effort to reach the field; the angle of his glide rapidly became more pronounced, and at five hundred feet he lost control. He hit with a hard bump in a cornfield. The impact threw him clear of the smash; his glasses were smashed and he was slightly bruised. He rode back to the field and was driven smiling around the enclosure amid the plaudits of the crowd.

The forerunner of catastrophes in aviation in this country took place at Overland Park, Denver, Colorado, on the 17th of November when Johnstone hurtled to his death. Lt. Selfridge, it is true, met his death earlier while flying with Orville Wright at Fort Myer, Virginia; but he was not acting as pilot, and no act of omission or commission on his part was responsible for the accident. To Johnstone went the mournful distinction of being the first airplane pilot to be killed in line of duty in this country. The last day of the year was to bring the total to three.

"Poor Ralph!" said Hoxsey later. "But it's all in the game. A weak plane, a sudden gust of wind, and then—" He shrugged his shoulders. Despite his grief at the passing of his friend Hoxsey did not allow it to interfere with his activities in the air. As was mentioned before—he was a fatalist. On the 19th he took off in spite of threatening weather, and was overtaken by a furious snowstorm. Undaunted Hoxsey climbed through the clouds into the clear sunshine.

Dominguez Field, Los Angeles, had its second aviation meet during the last week in December, and again Hoxsey was there; but in a somewhat different capacity. On the 26th, in quest of the altitude record, he reached the greatest height he was fated to attain: 11,474 feet. Day after day as the meet progressed, striving to better that mark, he winged his way upward out of sight. The catch phrase of the moment was:

"Has anybody here seen Hoxsey?"

Tuesday he went to 6,800 feet; Wednesday, 8,500; Thursday, 10,005; Friday, 10,575. That he would break his own record seemed certain. Saturday, the 31st, inauspicious day, dawned with squally weather. The news of Moisant's death that morning at New Orleans was the chief topic of conversation in the hangars.

"He must have become weary from too much driving," commented Hoxsey, and he went on with preparations for what was to be his own last flight. He banished his sadness at Moisant's untimely end in work. Just before leaving the ground, he remarked:

"Of course, the success of this attempt is contingent upon the kind of weather I find up there. Some of the temperatures one en-

(*Continued on page* 117)

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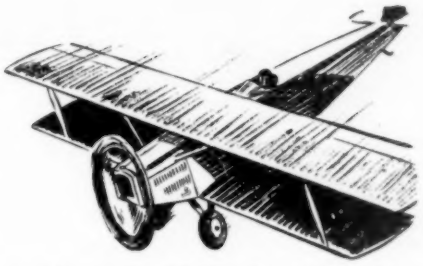

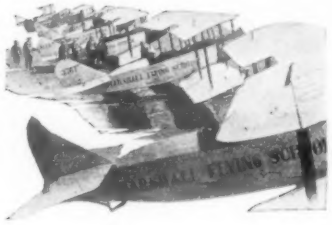

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Physical Effect of Altitude

By Thomas Carroll

Chief Test Pilot, Langley Memorial Aeronautical Laboratory, National Advistory Committee for Aeronautics

I HAD a most unusual experience which I wish to record, if for no other reason than that I do not believe I have ever seen a record of a similar experience before.

While flying the supercharged DH, our No. 6, in a straight supercharged climb to 25,000 feet, the oxygen apparatus, for a certain cause, failed within a few minutes after it was turned on between 17,000 and 19,000 feet. As I have upon many occasions been to altitudes higher than 20,000 feet, and on several occasions to or above 25,000 feet without oxygen, I kept on without it.

While using the oxygen for the few minutes at the altitude of around 18,000 feet the most noticeable effect was the immediate and very pronounced effect upon the eyesight in that immediately the oxygen was turned on the light appeared to increase to a degree of glaring brightness. I mention this fact only in regard to its relation to later occurrences. Above 20,000 feet and to a point around 24,000 feet I experienced no discomfort or any symptons of distress of disability due to the lack of oxygen, at least no more so than on other flights. The temperature while low, as was evidenced by the mass of ice which was brought back to the ground on the ship, afforded no discomfort, as I was extra heavily clad in all of my leather.

Immediately above 24,000 feet I began to experience a stifling feeling, due, I believe, to the lack of oxygen; and I continued for a period of a few minutes in order to satisfy my curiosity as to the effect. From then on I concentrated all my attention upon myself and merely continued the climb in a normal manner until approaching an indicated altitude of nearly 25,000 feet.

I had no preconceived ideas as to the effect of this lack of oxygen other than the effect upon the brain, which I had heard discussed considerably, which it is reported, apparently dulls the intellectual powers to the extent that it is difficult to read instruments or the like with any coherence, so that if I were looking for any symptoms it was for any of that nature. I can say that I am reasonably sure that I did not experience these sensations and that I read the instruments in rotation across the board continuously throughout this period without difficulty, and I am sure without error.

From the time that the oxygen had failed up to and including this time I had noticed a dimming of the light of the sun which was remarkable in view of the brightness which I noted during the short period in which I inhaled oxygen, and also from the fact that we had an absolutely cloudless sky and that at that time I was at least 10,000 feet above any haze that existed at the lower levels.

This impairment of the sense of sight was not alarming as I have found it on many occasions to be quite usual; and throughout the whole experience I believe a certain impairment of the hearing existed, although I would not care to say definitely on account of the fact that I wore a heavy helmet and it may have had more effect upon my hearing than would other causes.

However, at the maximum altitude of 25,000 feet, as mentioned, I experienced a numbing of a most peculiar nature in my hands and feet, very different from the effect of cold or of lack of circulation experienced in having a foot "asleep." It is better described as complete lack of feeling in those members accompanied by an almost complete loss of control over them, which I checked by attempting to move my hands and feet, that is, my fingers and toes.

This numb feeling progressed slowly but steadily up my arms and legs to points above my knees and elbows during which time a very much more rapid darkening set in.

Throughout the whole of this part of the experience which I do not believe lasted more than a fraction of a minute, I again believe that I checked my ability to think clearly and to read, by remembering a number of minor details which I called quickly and without effort to my mind. It was, however, impossible for me to read any of the instruments upon the instrument board: At this point I decided that I had sufficient information for this experiment and decided to discontinue it, whereupon I reached for the supercharger control, the engine and supercharger running full-out at this time, the supercharger control being a flat knob on the top of the instrument board which required pulling straight out. I found that I could neither grasp the knob nor move it with my left hand and that I was lifting my arm and moving almost entirely with my shoulder muscles. I thereupon attempted to grasp it with both hands successfully and shut it off. Then regaining my grasp of the control stick with my right hand and being able to push the throttle shut, I found that I was unable to grasp the control stick, but since it was only necessary to push forward on it I experienced no difficulty in this respect.

When I let go of the stick at full throttle the airplane evidently stalled, at least as soon as I cut the gun, but I do not believe that we spun. I know, however, from the force which I believe I was able to apply on the stick, that I went into and maintained a steep dive for a long time during all of which time the condition of darkness continued, even for a time getting worse. The degree of darkness attained, I believe, can be compared with late twilight just before the darkness of the evening, but of a more foggy order; and I caught one glimpse while diving directly toward the sun which appeared a yellowish red ball of very hazy outline, similar to a street lamp on a very foggy night.

I continued in this dive to an altitude of between 12,000 and 13,000 feet. At least this was the altitude when I felt sufficiently normal to flatten out and was able to read the altimeter. I found the air speed reading over 150 but I was unable at that time to distinguish the ground and ascertain my location. Flying about at this altitude for perhaps a minute I was able to distinguish the piers at Norfolk. Whereupon I returned to Langley Field. I flew around for several minutes to assure myself that I was all right before attempting to land, but upon landing experienced no more than the usual slight inconvenience of making a good landing after an altitude flight, which seems to be due to the focusing of the eyes or some such matter. Upon returning to the ground I again checked my experience against the possible effect of cold and I am convinced that it played no part in the experience.

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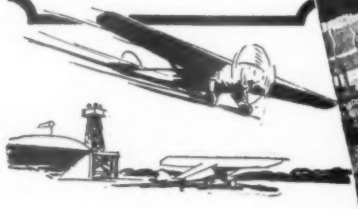

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Airplane Installment Selling

By William W. Luftig
Pacific Finance Corp.—New York City

NO industry whose merchandise can be sold on installments can hope to become of the first rank without using installment selling as a tool in its development. The aeronautical industry is just emerging from its infancy and if it is to grow rapidly and become of major importance, it must make provision for selling its products on the installment plan. Installment selling was just the device needed to in general the production of goods on a mass scale and it is undoubtedly true that mass production could not have occurred without it. In many respects the aeroplane industry is paralleling the automobile industry in its development, but it was this newly accepted principal of distribution that made the plan a notable success in the automobile industry and has been the cause of making it acceptable as the merchandising trend for the country. Installment selling was just the device needed to bring the automobile from being a rich man's luxury to that of a convenience and a utility.

Not all kinds of goods are adaptable to the installment method of selling, but the aeroplane is an article that lends itself readily to being sold on this plan. Goods that are low in price or that are intended for immediate consumption do not fit well to the budget system of paying. It is usually confined to merchandise of a durable nature; to articles that last for some time in the future after the last payment has been made. It confines itself to the more expensive class of merchandise. It involves goods that require large capital investments for all the units in the economic distribution of the product from the manufacturer to the jobber, to the dealer and finally to the consumer; to merchandise that is more expensive than the average consumer could ordinarily buy for cash. The type of goods that is sold on this plan is usually classed as luxuries but the luxury of today becomes the necessity of tomorrow. The aeroplane cannot be considered as anything but a luxury at present, but the automobile when it was first introduced was also treated as a luxury. Today it is considered, in general, to be a necessity.

Installment buying and selling has become a national habit and it is here to stay. It is based upon the principal of extending credit to the individual and is just another step in the history of credit—a natural evolution of the credit system of industry. It has installed itself as a permanent fixture in the American trade market and it has become a permanent part of the business structure.

The American public is rapidly becoming air-minded. Public interest in aviation has been stimulated by Lindbergh, Byrd, Chamberlin and others. Commercial air lines and carrier businesses are developing fast. New companies for the manufacturing and operating of aeroplanes are being formed. The investing public is favorably inclined to the new industry and the future of the industry is assured. The rapidity with which it develops however rests upon placing of machines in the hands of those who desire them and at an initial payment which is not much more than is required as a down payment on a popular priced automobile. The aeronautical industry can look to the automobile industry to visualize the extent to which it can develop, but it must bear in mind that the automobile industry was nursed on the milk of installment selling.

Installment selling is not one of the problems of the aircraft distributor in the present market, but the wise dealer is preparing for the future and keener competition.

Skepticism and ridicule greeted the introduction of the automobile. The "horseless buggy" was considered a dangerous contraption to ride in, unreliable in performance, costly to operate and too expensive to buy. The aeroplane today is regarded by many in much the same way. But the aeroplane has passed from its experimental stage and is here in fact. It is no longer a novelty. The flying age has arrived. In the hands of trained persons the aeroplane is as safe as is an automobile. Scientific problems rather than mechanical perfection are engaging the attention of the industry.

An aeroplane is a fairly expensive vehicle. The lowest priced planes compare in price with the highest priced automobiles. In 1895 only four automobiles were built in the whole United States. Now there are almost 25,000,000 motor cars and trucks in the country. The increase was made possible because of installment selling and mass production. In 1904 a Packard touring car sold for about $7,000.00—now a Packard touring car with steel body, increased mechanical perfections and accessories and far better in every way from its early predecessor, sells for $2,500.00. In 1904 the Ford touring car sold for $1,200.00—it now sells for about $400.00. The decrease in the selling price was made possible thru installment selling and mass production. At present there are less than 7,000 privately owned planes for the entire country. The rapid increase in sales of the automobile was made possible because a demand developed for the product and progressively decreasing prices tended to accentuate the demand. One means of increasing sales to individuals is to decrease prices and mass production of aeroplanes will result in lower prices. Mass production however is synonymous with installment selling and when planes will be sold with a down payment not much above the down payment required on popular priced cars, then increased production will result.

Several finance companies have been formed to finance the manufacturing of commerical and carrier planes and to provide funds to operate these lines using these planes. Capital is too timid to finance planes on installments to individuals. Requests from individuals to existing automobile finance companies to finance planes have not been favorably received. There is a decided need for some large finance companies to finance dealers in obtaining machines from manufacturers and then to finance individual buyers so that they can buy these planes from the dealers.

The bankers hold the key to the situation through the control they exercise in the discounting of install-

ment paper. Without the help of the banks to discount installment paper of individual buyers of planes, held by finance companies and dealers, the industry must of necessity advance at a slow pace. Colonel Lindbergh made Congress air-minded by taking its members and their families on trips in his plane. An educational campaign to make bankers air-minded may well be worth the trouble and expense. The automobile industry has succeeded in the majority of cases in making bankers installment - minded, but even after twenty years of hard work there are still many bankers who consider installment selling unsound and vicious. Those who condemn the system base their conclusions upon wrong premises and from insufficient and inaccurate facts. Their opinions are not supported by facts and statistical conclusions. Installment facts refute installment fancies.

The far sighted business man is not concerned with arguments about the advantages or disadvantages of installment selling, but he is concerned with eliminating its abuses and imperfections. Lax terms—small down payments and long maturities over which to pay the balances, needs correction. Greater care should be taken in selecting credit risks and collections should be followed up vigorously. But these are problems with which the aeroplane industry need not as yet worry. They will solve themselves when the industry reaches that stage where they become of importance. At present the industry is riding on the crest of the automobile industry and the selling of aeroplanes on installments will bring into existence another giant industry.

Los Angeles Aero Club

The Wings Aviation Club was organized by a group of World War Veterans, at a meeting held recently. The purposes of the Club are to promote aviation in general and to enable members to learn to fly.

It is also expected that a number of members who have already made solo flights will get the fifty hours flying required by the Department of Commerce regulations for a pilot's license, at a minimum of expense. Membership is open to any one interested in Aviation, both men and women. Wynn Blaisdell, the Secretary, will be glad to hear from prospective members at 940 S. Flower St., Los Angeles, Calif.

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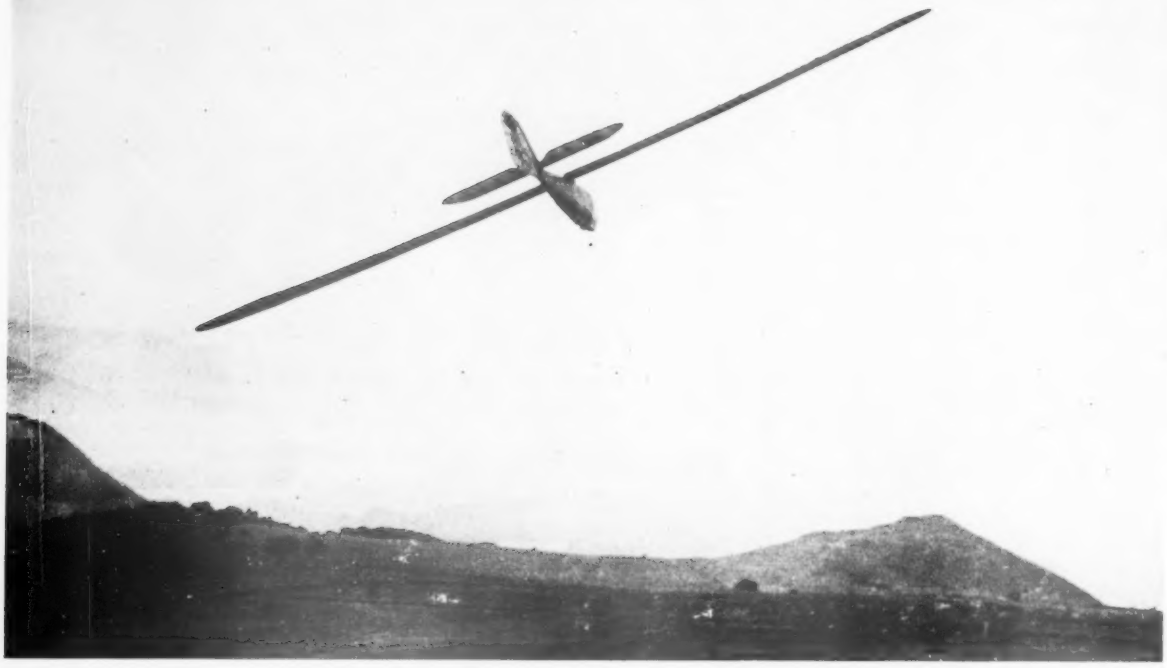

Herr Kronfeld, Austrian flyer, reached an altitude of 1,770 feet in this glider.

The Construction of Sailplanes

By Alfried Gymnich

Translated by John H. D. Blanke

ALL the well known and outstanding sailplanes belong to the second group of our classification—those with control by rudder manipulation. This control is exercised either by the distortion of the control surfaces according to the example of the Wright Brothers, or by the manipulation of suitable control valves or boards as is customary in the construction of motored planes. Naturally the control of a sailplane by means of special control organs or surfaces is considerably more sensitive and essentially more favorable for conditions of stability than the quite primitive control by displacing the weight of the body. It is therefore not surprising that the suspension or hanging glider is today nearly crowded out of the field of sailplane construction.

At the beginning of the sailflying movement most of the sailplanes, as in the motor flying field, were biplanes. This is explained by the smaller surface load and the relatively simple construction in spite of the greater strength. Thus, by bracing the two wings in connection with the diagonal reinforcing, a great static construction safety is obtained with simple constructive means and in spite of the small span width a great surface area is possible.

Through the introduction of the free-carrying or non-reinforced design by Professor Junkers the monoplane, however, soon gained in importance, and in the first Rhoen contest the tremendous superiority of the non-reinforced sailplane had already showed itself. With the same velocity in sinking and the flying speed increased by the elimination of all exterior stays and wires, the gliding angle was thereby decreased, so that in contrast to the reinforced biplane such aerodynamically high grade sailplanes of the new type can sail under comparatively small wind velocities.

The weight of the free carrying monoplane is naturally greater than that of a reinforced plane of the same surface area, but the sailing qualities need not be influenced detrimentally by this question of weight. For example, if the gliding figure of a plane, that is, the rela-

tion of the resistance to the ascent, is 1:10 one may say that the reduction of 1 pound effects a lifting of 10 pounds of the weight of the plane. Therefore, as long as less than 10 pounds of construction weight are used for the reduction of 1 pound of detrimental resistance, there is always an advantage left in favor of the sailing qualities.

The free-carrying monoplane with control by displacing the rudders can be considered as a standard, whereas for schooling and instruction purposes the strutted, or braced and reinforced monoplane deserves the preference. The purpose of the schooling plane is to acquaint the student with the initial stage of sail-flying, which is gliding flight, so that later he may control a high grade sailplane successfully. Naturally a less strong ascending current is required for a plane with a low sinking velocity than for a plane with a greater sinking velocity. However, it would be a fallacy to assume that one must build a plane for the static sailing flight which shows extremely low surface load and with a minimum sinking velocity. Such a plane is possible only by sacrificing aerodynamic efficiency because a lightly built plane requires reinforcing, stays, etc., on the outside. The detrimental resistance caused thereby consumes a large proportion of the flying speed, which is necessary for attaining a good gliding figure. This is understood when one considers that the gliding angle of a plane is derived as the resultant from the sinking speed and the flying speed; so by increasing the flying speed—precluding constant sinking speed—the gliding angle flattens. Therefore, in construction, efforts should be made as well towards low sinking speed as towards great flying speed.

The duration flights of Schulz, with his first primitive sailplane (illustrated in the last issue of Popular Aviation), shows that it can also be desirable to have a low flying speed in order to hold the plane in the ascending wind zone during the duration flight. Schulz permitted himself, without flying curves, to be pushed back and forth above the dunes by the wind. With an areodynamically high grade and easily controllable sailplane one can remain in circular or elliptical tracks within the range of the slope wind, but this requires a far greater skill and experience than the first method. One will always have to build a sailplane more or less in accordance with viewpoints that are determined by con-

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A tailless sailplane which in design is an imitation of the seagull.

ditions of the land and the average winds.

Before continuing to the third group it would be well to become familiar with the control organism of a sailplane controlled by rudder adjustment, especially since, in later installments, we will deal with such planes only.

A sailplane controlled by adjustment of the rudders has three control organisms:

1. The altitude control (for flying up and down).
2. The side control (for flying sideways).
3. The transversal control (for maintaining transversal stability).

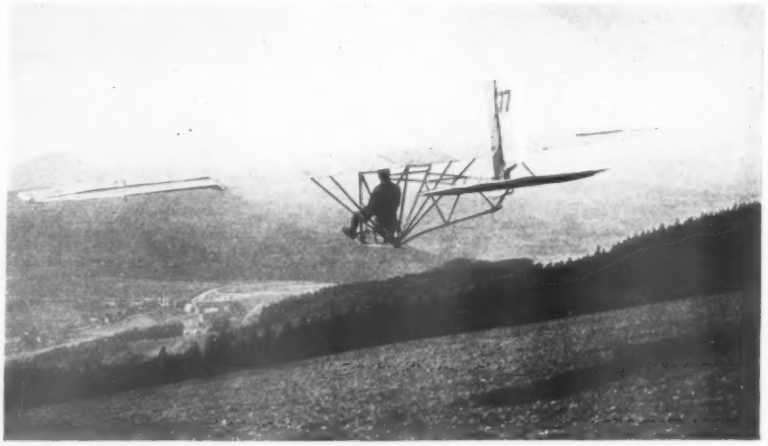
Altitude and transversal controls are operated by a vertical control stick which can be moved to all sides. The side control is actuated by a double foot lever. Corresponding to these three control organs the plane can be turned in the air around three axes, as shown in figure 8. These are the transversal axis A-B, the vertical axis C-D, and the longitudinal axis E-F. The controls operate in the same manner as do those on a motored plane equipped with stick control.

The transversal axis is not, as one would suppose, formed by the center of gravity (point of balance) but by the resultant of the air forces attacking the carrying wings. This resultant, called the average pressure line, is dependent upon the cross section of the carrying wings, therefore the profile and the angle under which the carrying wings are exposed to the direction or flow of the air (angle of attack). This is located in about the first third of the carrying wings. In a well controllable plane the center of gravity coincides with the average pressure line, or is a little ahead of it, therefore the plane, left to itself, will automatically pass into a gliding flight.

The side control is, as already stated, operated by means of a foot lever, according to figure 8, 1. A movement of the lever or rudder bar to the left effects a movement of the rudder to the left. The air forces press the end of the fuselage to the right resulting in a movement of the nose of the plane to the left. This rotation takes place about the axis C-D.

Both controls together assure the plane its mobility and permit the flyer to change the direction as needed. The third control arrangement, the transversal control, serves first of all to maintain the transversal stability, and besides assists, in a certain degree, in curve flying. Gusts, that is, irregular winds, attempt to bring the plane out of balance. Gusts attack to a large degree irregularly, which means that they lift or lower one side of the carrying wing. The machine can be brought back from this inclined position by means of the transversal controls. They are flaps which are jointed to the rear beam or the ends of the carrying wings and are rigidly coupled so that a positive movement of the one results in a negative movement of the other.

The third group consists of the planes controlled by the wing sur-



Shortly after the start with a schooling sailplane.

The author is landing with a suspension glider.

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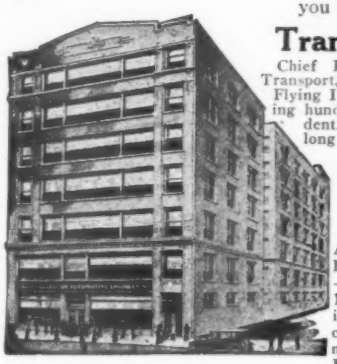

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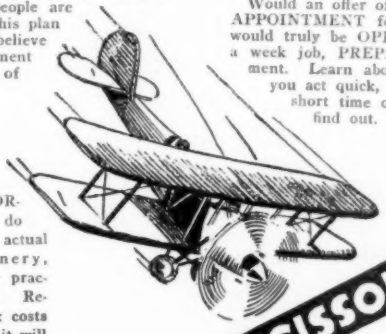

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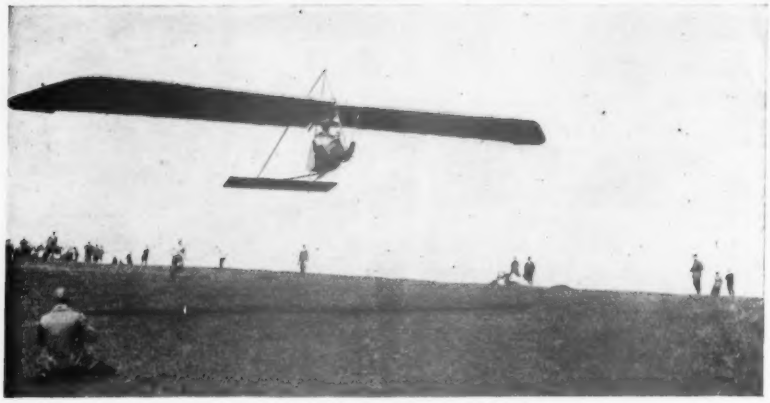


A wing-controlled sailplane shortly after the start.

faces themselves. Planes controlled by rudder adjustment proved themselves too slow for utilizing the inner energy of the wind or turbulent air currents. Due to the absence of suitable instruments for determining the strength and direction of an increase in air velocity the flyer can depend only on his senses. He detects changes by means of the feel of the control stick. The lifting effect of the wind on the carrying wing signalled to him by the control stick tells him that an increase in wind velocity has started. Without knowing clearly its range and direction he operates the altitude control in order to give the carrying wing a greater angle of attack, so that he can utilize the increase in wind velocity. In any case a certain amount of time is lost until the angle of attack is increased by moving the altitude control, and sometimes the gust has disappeared before the latent energy in it can be utilized.

First of all the flyer aims, in order to increase the angle of attack, at a greater mobility in the longitudinal direction, by shortening the fuselage. The shortening of the lever arm effected thereby requires, however, greater control adjustment or larger control surfaces. This method brought forth no more improvements of dynamic sailing flight than did the tailless type with the arrow shape which has the wings sharply inclined to the rear.

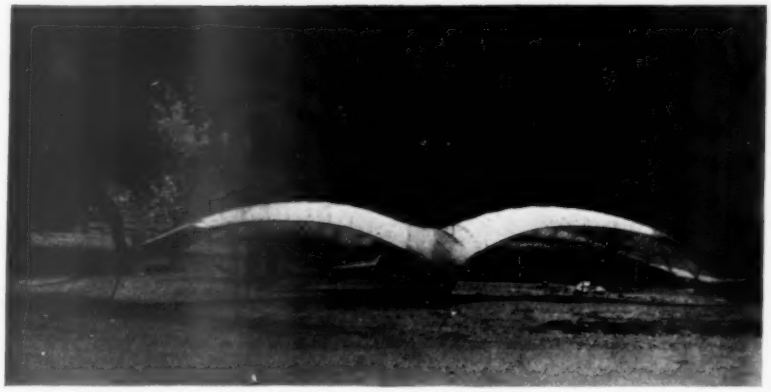
In order to be able to take hold of the gusts directly and to use them for sailflying it was necessary to make the wings themselves controllable. Here, as in the development of the transversal control, two paths have been followed. In one the carrying wings have been designed so

The author during the start with a wing-controlled plane.

that they can be readily distorted by means of control cables, jointed ribs, and other devices. In the second method the wings are so constructed as to rotate about the main beam. Both types of control have been carried out in practice. The first type is the more difficult from a technical standpoint but has produced the best results. In part the wing halves are connected as in the transversal position control, so that a positive adjustment of one wing half results in a negative adjustment of the other wing half. The adjustment of each wing half can be done as desired by the use of two control sticks.

Occasionally the carrying wings are also planes rotatable as a whole and are equipped with normal transversal controls for the transversal stability. This is the case with the sailplane "Geheimrat" described in

High above the slopes of the Rhoen. This photograph illustrates especially well the ideal side of the sailflying sport.



A sailplane simulating a bird.

a recent issue of POPULAR AVIATION.

However, it cannot be maintained that planes with wing control are superior to those with control by rudder adjustment for the static sail flight. On the other hand, nearly all the important records have been established with planes of the latter design. Many serious accidents to planes with wing controls have not exactly encouraged attempts along this line. Wing controlled planes are exceptionally sensitive to control and can easily be over-controlled and turned over.

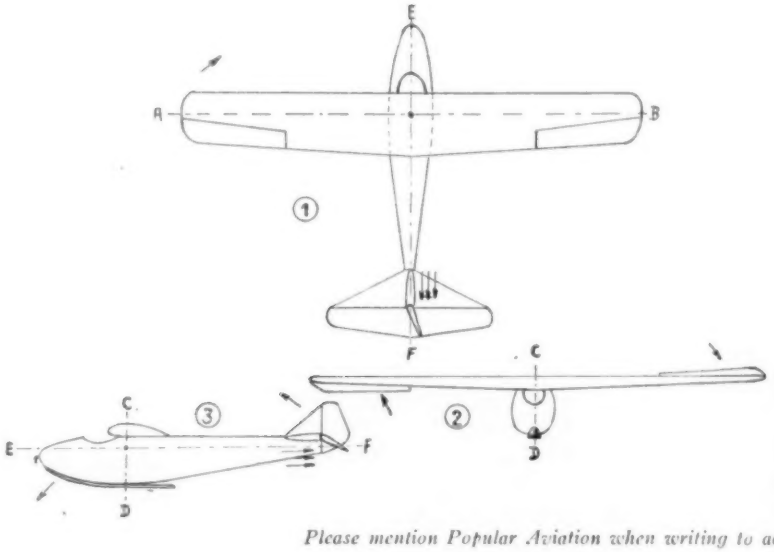
The forces which come into play or are affected by an adjustable wing during flight have not been sufficiently determined mathematically and consequently many wing breaks occurred. It would be regrettable, however, if experiments in this direction were entirely discontinued. It is recommended, that if such experiments are to be continued, that sufficient data be compiled about the construction and operation of such planes over level territory. The purpose of the wing controlled plane lies in the utilization of the irregularities of the wind—therefore in the attaining of dynamic sailflying effects.

At this point we can not, however, deal further with the wing controlled sailplanes, since they do not fit into the present discussion. This special form of construction will be reserved for later consideration, as it is a good plan to take up the actual work of construction and designing after the theory and practice of flight is understood.

(To be continued)

(Mr. Gymnich's future articles will deal with the further mechanical and theoretical considerations applicable to the construction and operation of the most approved type of sailplanes.)

Illustrating the control effect of a sailplane.
1. Side control.
2. Transversal control.
3. Altitude control.



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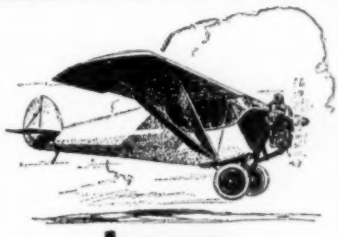

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Current Comment

The Larger Popular Aviation

We have again increased the size of *Popular Aviation*. Suggestions from our readers, letters of both praise and dispraise have led us to take this step which we feel will result in a better magazine. The reading matter is more diversified, new departments have been added and several features are in prospect for the readers. For example, the series by Professor Klemin, starting in this issue, should prove of interest to everyone. Aerodynamics is a dry subject when treated in a purely mathematical way. In fact, it is one of the studies in which a student can make little progress except in a class room. Professor Klemin has simply taken class room illustrations and welded them into a text book that anyone of ordinary intelligence can understand. It does not require a college degree, nor a course in physics to digest the subject matter of this course in Simple Aerodynamics. As a piece of educational work it is an accomplishment on the part of Professor Klemin; and Popular Aviation takes a small share of the credit in thus presenting it to the interested student of aeronautics.

The Transcontinental Races

As we go to press, for presses and printers wait for no man, we expect to hear the results of the transcontinental air races and to have it drummed into us again that the distance across this great continent has been reduced again. Soon, if not by the time this magazine appears in print, it will be possible to span this country in daylight. It may mean little to the rising generation, but what does it mean to a man like Ezra Meeker, for instance, whose first trip from East to West was in an ox cart. To him it carries a meaning that cannot be appreciated by the youth. To the plane manufacturer it has a different meaning—a vision of wider markets. To the engine designer it signifies the triumph of machinery over what was an apparently insuperable problem a few short years ago. It is probably idle to mention again that races in aviation have the same effect, in the long run, as the automobile races have had. They afford the great practical proving ground for new developments, an attention-compelling demonstration of progress before the eyes of the people.

We Are Flattered

On our desk is a letter from Paul Garber, of the Smithsonian Institution, suggesting that we forward to the National Museum the artist's original painting which was used for the September cover of Popular Aviation. It is to go in the National Museum, to be hung on the wall back of the Loening Amphibian in which Major Dargue made the Goodwill Flight through Central and South America. We cannot resist it—it goes forward today; and we cannot resist mentioning the artist here. Otto Brennemann was an air observer in the German Army before coming to this country and is one of the vanguard of an army of artists to come—a man who has seen and knows the beauty of the land and the sky when seen from an entirely different viewpoint. Things are different when viewed from the air above and the artist without air experience is more than handicapped in picturing it. We are glad that something of Mr. Brennemann's work is to be preserved in our National Museum.

Greenland's Icy Mountains

The expedition of the University of Michigan now working in Greenland has come into prominence because of the rescue of Hassell and Cramer. Otherwise it might have spent its weary months in that icy waste without attracting the attention of the public. Professor Hobbs and his colleagues are there for a purpose that will, in all probability, result in the saving of life and property. The information that they are collecting will have no front page value to the newspapers, and the lives saved will never be mentioned in print, but the value of their contribution to aeronautics is not difficult to see. They are making an investigation of the weather conditions in Greenland, the great breeder of storms, and it is more than possible that this scientific study of weather will have an influence over the future routes to be chosen in the crossing of the Atlantic by air. Comparatively speaking we know little about the upper air, and less about the air over the North Atlantic. These studies will give us something to go on, something on which more accurate weather forecasts may be based, a starting point for a survey of upper air conditions between this continent and Europe. A straight line is not always the shortest distance between two points in respect of time. It may be that facts about wind conditions and storm areas may be uncovered that will demonstrate the wisdom of utilizing different routes and the ignoring of the great circle route. Practical business owes more to the dry scientist, with his instruments, his charts and his data, than most people appreciate. The sad part of it is that the reward never seems to be commensurate with the service performed.

The Financial Stage

Aviation has had its ups and downs before, but the present "up" is accompanied by something more than interest on the part of that section of our life known as "Capital." Moneyed interests, money in

Current Comment

mass, capital, the banks, Wall Street—call it what you will—for the first time shows an inclination to make investments in aviation enterprises. This is more than a good sign. It is definite indication that aviation has taken its place as a financial factor in life and business. Along with that consideration comes the thought that capital, as capital, does not permit businesses to fail. Bad management, lack of foresight, and other faults that wreck the privately owned business do not stop the business that is backed by moneyed interests. A new management steps in and the business goes forward to the goal of larger sales and dividends. The influx of capital is a good thing for aviation in more than one way.

The Patent Department

We have received many letters from readers of *Popular Aviation* relating to inventions. For every one we have received there are probably many that have remained unwritten, for no inventor likes to expose unprotected ideas. For that reason *Popular Aviation* has made arrangements to be represented in Washington, and inquiries regarding patent matters may be addressed to us there. Refer to the patent department in this issue for the address and other particulars. We are able to guarantee the good faith and integrity of our Washington representative and to assure our readers that their questions relating to patent matters will have expert and confidential attention. However, nothing will take the place of an experienced and reliable patent attorney in matters of this sort, and let us respectfully suggest to those who contemplate using this service that they inform themselves on this score.

Opportunities in Aviation

We suppose that every airplane manufacturer, distributor and dealer, as well as every business connected with aviation, is overwhelmed with the applications of earnest young men seeking to gain a foothold in aviation. In fact, those to whom we have mentioned this matter have said that it is impossible to keep any record of the applicants, and that the best way out of an enormous amount of clerical work is to pay no attention to such applicants. It is for that reason that *Popular Aviation* has undertaken the work of becoming a sort of clearing house for the employers. On another page will be found the first announcement of this service. We will undertake to sort and classify the human material available in the industry and to hold it in readiness for those who need the services of these men. May we offer here a word of advice? Qualified men are needed. There is a definite shortage of experienced men and men with certain types of training. Actual aviation experience is not always a requisite, but something more than mere ambition and a desire to break into the "game" is needed. As for the employer, may we suggest that there is a wealth of human energy available, energy backed by determination and enthusiasm, and that as time goes on their use of this clearing house will prove good business.

The Outsider

The parallel between the railroads and aviation drawn by our anonymous contributor, "An Outsider," is worth considering. The chief difference between a man with aviation experience and any other business man is that the other business man thinks his business is different, while the aviation man knows it is. It may be that this attitude can be carried too far. Quite a little good natured fun is poked at the attitude by the experts, who are inclined to run to the opposite extreme and state that all business is basically identical. Be that as it may, it would not hurt to give a railroad man of the experience that the "Outsider" has had an audience, even if you do not agree with him. He brings up things we know you will not care to accept, but basically his criticisms, even when the grounds are unproved, are correct in many instances. His interest is not casual, it is deep, and it may be that he can be drawn from his insistence on remaining anonymous at a later date.

Gliding and Sailflying

There must be enthusiasts in this country who have had actual experience in gliding and sailflying. We do know that there are many who wish to take up this sport but lack leadership. Men with a knowledge of the art, or science, or sport, whatever you wish to call it, are hard to find. We would like to get in touch with as many of them as possible. There is an actual field for their services, just as there is a field for the services of instructors in motored flight. It simply needs developing and a little cultivation. There are hundreds of localities in this broad country where conditions for sail flying are ideal. Groups of men are drawing together to investigate this sport which leads to motored flight. We believe that sailflying, as the Germans prefer to call gliding, has been responsible in a large measure for the quality of "airmindedness" now displayed by the German people. It brings flight within the reach of greater numbers, makes the sight of planes in the sky a more frequent thing, and brings home to the people at large, the ultimate safety of the air as a mode of travel.

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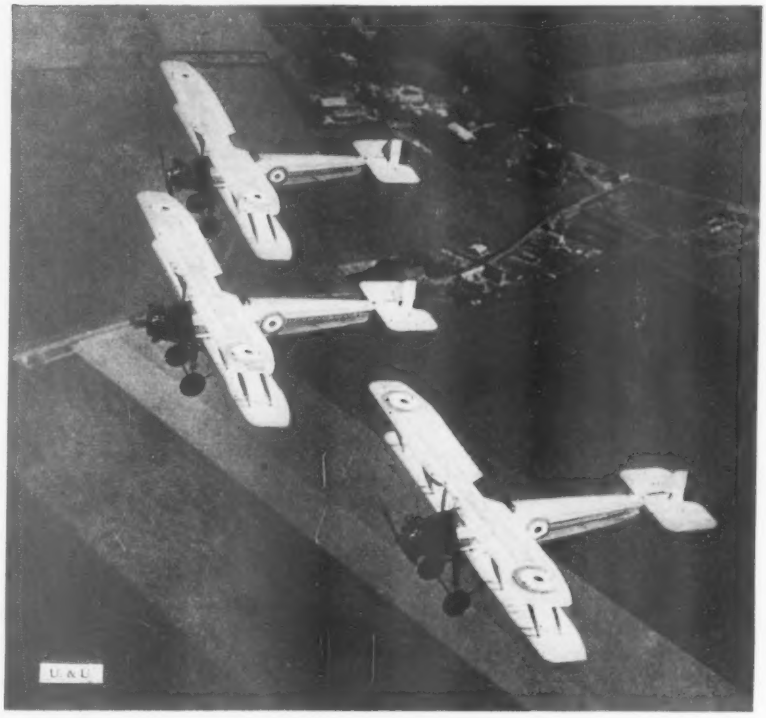

Planes of the Oxford University Air Squadron flying over Manston Aerodrome, England.

College Aero Clubs

University of Southern California

The University of Southern California has recently established a Ground School Course leading up to actual flying school work in some other university or school. The work is under the Department of Mechanical Engineering and, according to their expectations is only the beginning of their work in Aviation.

University of Nebraska

The University of Nebraska has had an Aeronautical Group of the Department of Mechanical Engineering for quite some time. The course as established offers the selection from the following: Heat Treatment of Metals, Aeronautical Engineering, Aeronautical Engine and Equipment Testing, Aeronautical Engine Design, Structures, Research, and Thesis.

Intercollegiate Aviation Conference

The president of the Yale Aeronautical Society, Mr. N. L. Englehardt, Jr., has formally announced that the Intercollegiate Aviation Conference will be held at New Haven, October 19-20, 1928.

Extensive plans have been made for a very successful conference to meet the needs and offer a solution of the problems of college clubs and other aeronautical organizations.

The following subjects will be open for discussion:

A. Organization of College Aero Clubs.

B. Financing of Clubs and Planes.

C. Activities of Clubs including research, instruction, flying and social activities.

D. Intercollegiate activities, including air races, glider contests, research competition, air meets, and intercollegiate organization.

Suggestions for the development of a standard ground school course with a special aero club text-book have been received as well as a suggestion for the development of a standing commission to control intercollegiate activities in aviation.

It is hoped that western colleges

that cannot be represented on account of travel distances will appoint an eastern college as their delegate, or a group of western colleges might send one representative.

It is certain that this conference will accomplish considerable as already several colleges have established most successful organizations whose influence and progress have been a source of tremendous interest not only to the universities, but also to the industry itself.

Intercollegiate Air Race

The Contest Committee of the National Aeronautic Association in consideration of several requests received from those most interested has authorized the postponement of the 1928 Intercollegiate Air Race for the Loening Trophy which will now be held at Mitchel Field, Long Island, on Saturday, December 1, at 2:00 P. M.

The postponement was granted in order to provide additional time for flying organization under the direction of the various college flying clubs who will compete.

The Intercollegiate Race will be for speed in attaining one mile of altitude. Each college flying club may be represented by a team of three pilots. For eligibility the student can not be engaged in commercial flying activities or on active duty in the military services.

University of Minnesota

The University of Minnesota has established a four-year course in Aeronautical Engineering leading to the degree of Bachelor of Aeronautical Engineering.

The first year of this course is the same as that of civil, electrical, mechanical, and agricultural engineering. The present freshmen can enter this course this fall as sophomores. The curriculum is built around the mechanical engineering course so that a student not desiring to enter the field of aeronautical engineering may enter some other branch of engineering. The fundamental courses such as mathematics, English, chemistry, physics, drawing, shop work, applied mechanics, strength of materials, and hydraulics are included in this curriculum. The courses in the special fields of engineering such as kinematics, mechanism, machine design, thermodynamics, steam engineering, electric power, surveying, and structural mechanics are also included. The courses in aeronautical engineering to be taught are: a general introductory course in aviation and airplane motors, followed by aerodynamics, principles of airplane construction, propellers, motors, airplane design, airships, air transport, airplane and aerodynamics laboratories.

The University of Minnesota has a special advantage in that it is located in the center of the aeronautical activities of the Northwest.

It is understood that the University of Minnesota is not training airplane pilots, but such students as can pass a flight physical examination may enter the Air Reserve Corps of the U. S. Navy and receive actual flight training during the summer vacation. This training leads to a reserve commission in the U. S. Navy Air Corps.

Purdue University

Purdue University has been giving instruction in Aeronautical Engineering since 1919. These courses are given as "options" in the senior year, and in the post graduate years in the School of Mechanical Engineering.

The following courses in aeronautics are now given: Aeronautical Engines, Aeronautical Engine Design, Aerodynamics, Advanced Aerodynamics and Airplane Design in the senior year; Advanced Airplane Design and Airplane Structures, and Theory and Design of the Air Propeller in the post graduate year.

The University has not, so far, conferred the degree of Aeronautical Engineer. However, those who elect the aeronautics option in the senior year in Mechanical Engineering are able to pass the Civil Service examination for Junior Aeronautical Engineer. A number of the graduates are now employed as Junior Aeronautical Engineers at Wright Field, Dayton, Ohio, and at Langley Field, Virginia. Several are employed by airplane manufacturers. This year, twenty-five men are enrolled in the aeronautics option.

The laboratories in experimental engineering are available for testing of aviation engines and airplane structures. The Gas Engine Department is equipped with two electric dynamometers of seventy-five (75) horsepower capacity each, prony brakes, carbureter testing plant and other apparatus for the performance testing of gasoline engines. A new aeronautical laboratory equipped with nine aeronautical engines and three airplanes will be ready for use in September. The University does not have a wind tunnel.

There is now at the University an unofficial Aero Club consisting of about twenty-five students who are interested in aviation. This club expects to be officially recognized by the University this fall as the Purdue Aero Club.

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Clearing House for Aviation

WITH a view to offering a service of substantial value to individuals and organizations interested in the many phases of aviation POPULAR AVIATION is now prepared to give its readers a listing and placement service for which no charge will be made.

It is our belief that this service will provide a means of bringing employers in touch with the best prospects for the many positions which the rapidly expanding business of aviation is now making necessary.

It will afford an opportunity for young men seeking a foothold in this growing industry to list their names and qualifications and have them forwarded to prospective employers. It will enable those who have special services to offer to get in touch with clients or customers.

It will permit those who are looking for specific qualifications or particular ability along certain lines, to come into contact with those possessing it with a minimum of trouble and correspondence.

Students may use it for obtaining the names of schools in certain localities.

Chambers of commerce and civic organizations can secure the names of men qualified to advise them with regard to airport developments, the feasibility of projected industries along aviation lines, or matters of that sort.

Operators of flying circuses may list their names for engagements, speakers on aviation topics, and a host of others will find it to their advantage to take advantage of this service, which will be offered without charge.

From the first POPULAR AVIATION has had an enormous correspondence. Inquiries on widely diversified subjects are being made constantly. A pilot having some ideas of design wishes to get in touch with a man capable of making stress analysis. A student wishes to know the aviation school nearest his home. A city alderman wishes to know who can tell him how long to make the runways on the municipal field, how to drain the field and how to organize it for business. A foreign youth with a remarkable service in airplane factories abroad wishes to know where he can find employment and learn English at the same time. A man with a really sizable capital to invest wishes to get in touch with an engineer capable of investigating a manufacturing proposition offered him.

These are only samples of the type of letters answered daily, and it is this that has encouraged POPULAR AVIATION to offer this service to its readers in the belief that it will be of real value to the industry.

Naturally certain conditions and requirements must be laid down. It must be understood at the start that this service is free. No positions can be guaranteed. No correspondence can be entered into with reference to any applications. No letters can be considered as a part of any application. Applications for listing must be made on the blanks which will be printed in every issue of POPULAR AVIATION.

At this point it might be well for POPULAR AVIATION to issue warning. We are aware that there are thousands of young men desirous of obtaining a foothold in aviation. Mere ambition and a desire to fly are not sufficient qualifications to convince an employer that the applicant is desirable as an employee. At the present time the number of such men is far in excess of the number of positions now open, or the number that will ever be open.

Most young men seeking to enter aviation forget that there are from ten to sixteen positions on the ground in aviation for every one in the air. Men have to fill these places. Factories need mechanics, draughtsmen, painters, electricians and men of many trades. Soon the transport companies will be needing men with experience such as is gained in railroad traffic departments. Bookkeepers and auditors, stenographers and stock clerks are part of the industry. As in any other business advancement depends upon individual merit and application. Not all our young men can fly the air mail.

No employer will be furnished with the name of any man at present employed by him. In this respect the Aviation Clearing House will offer a confidential service for men already employed and desirous of seeking betterment or a necessary change.

Applications will be classified and employers will be furnished with copies of all blanks in classifications he desires. POPULAR AVIATION will do all it possibly can in making this service known to employers and in furnishing lists of applicants, but it cannot agree to place any applicant. No fees will be accepted for any service offered and no fees can be offered for any additional service or attention.

The listing blank, which will be found on this page, has been carefully prepared to cover the necessary data and no letter should accompany it or contain any portion of the data required on the blank. Certain of the questions are applicable only to those seeking employment. Others may omit the answers to these questions. Please do not write in the space in the square, as that is for our own indexing purposes.

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Address..... City..... State.....

Age..... Married / Single..... Nationality.....

Education .....

(State here course at college, high school or equivalents)

Aviation Experience.....

.....

Pilot..... Mechanic..... Kind of License:..... No. of Hrs.....

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Position Desired..... Minimum Salary.....

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Our Library and Yours

THE other day I picked up a booklet intended for political campaign matter and found it to be illustrated with a wealth of aerial views. The photographs brought out clearly the matter the text elaborated and it struck me at the time that here was one of the last things you would mention as suitable for illustrating with photographs taken from an airplane. It simply represented the ever growing use of the airplane and emphasized that section of aerial work that receives so little attention—photography.

There are few texts for the aspiring airplane photographer to study, but Airplane Photography by Ives (Lippincott—$4.00) helps to fill the gap. Containing the fruit of his years of work on this particular line the author has condensed his experience into the seven general heads under which he sets forth practically all the data available on this subject. He takes up in detail the camera itself; the mounting, or suspension, and installation of them in the planes; sensitized material and chemicals; developing methods; films and papers; practical problems and data; and finally takes an excursion into the future of aerial photography.

The illustrations are apt and clear up the few difficulties the novice may find in reading the text matter. I could find it easily possible to become enthusiastic over Mr. Ives' profession, and when I thought of the uncharted and unmapped portions of this old world I laid down the book before the wanderlust seized me.

And it was my luck to pick up the "Three Musketeers of the Air" (Putnam's — $2.50) published to commemorate the flight of the "Bremen" with Fitzmaurice, Koehl and Von Huenefeld. Each of the three flyers described the flight from Baldonnal to America and the descriptions are characteristic of the men. I noted the fact that while Koehl was with a bombing squadron of the Germans, Fitzmaurice was a member of the Royal Flying Corps, and of course I wondered if this flight together was their second meeting, and that if Fitzmaurice had been quicker on the trigger some years ago would he have had the chance to fly with Koehl, or if Koehl had been a hair more accurate would Fitzmaurice be here today. But that is idle, because the flight itself was a demonstration of the fact that war enmities are forgotten.

When you put this book down you cannot help but admire the courage of the three men who braved everything to make this flight. Possibly the greatest thing they overcame was the set belief that many did not hesitate to express to them, that it was impossible to fly the North Atlantic from East to West. And I will also venture to say that you will help fly that Junkers with Koehl as you read his description and you will see the swirling fog, the black night, and you will seek with him for the coast that tells you you have succeeded.

But the wanderlust is never stilled by such books, so in pure self defense and to remind me that aviation is not only an adventure but a science and a business I selected Aeroplane Construction, Operation and Maintenance by Rathbun (Stranton —$2.50) and then I realized that it was written by a man who realized that there was a need for a book devoted solely to the subjects expressed in the title. Little of romance here, although Mr. Rathbun does go into the history and progress of aviation, but only for the purpose of explaining the various changes in design which have resulted in higher efficiency and better performance.

I can see the value of this book to the student, for enough Aerodynamics are given, and in simple language, so that lift and drag ratios and matters of that sort become something more than mere formulae. Some writers consider the mere heading "Aerodynamics" as a license to become discursive and abstract and to bring in questions of higher mathematics that should be confined to books for engineering students. I am convinced that everyone should understand the principles of aerodynamics, and I am grateful to anyone who can convey the rudiments in easily understandable form.

The mechanic will be interested in this book as it offers him a handbook on construction that is illustrated

NEW BOOKS RECEIVED

Line of Position—Weems $1.75
Star Altitude Curves—Weems 1.75
An Alphabet of Aviation—Jones (Macrae-Smith) 2.00
Flying the Arctic—Wilkins 2.50
Three Musketeers of the Air—Koehl, Fitzmaurice, Von Huenefeld 2.50
Elements of Aviation—Clark (Ronald Press) $3.00
Wings—Saunders (Grosset & Dunlap) ..... .75
A. B. C. of Flight—LePage (John Wiley) 1.50
Engineering Aerodynamics —Diehl (Ronald Press) 7.00
India by Air—Hoare ..... *(Longmans)*
Rigid Airship—Lewitt (Pitman)
Grosser Luftverkehrs — Atlas von Europe.

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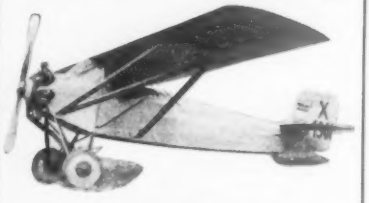

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and explained in a concise and interesting style. It would be a good addition to his book shelf.

Thus encouraged, and still of the belief that aerodynamics is a subject that every airminded person should understand I opened the latest edition to the Ronald Library, Elements of Aviation by V. E. Clark (Ronald —$3.00). Just to show that Colonel Clark is particularly qualified to write on this subject it might be interesting to note that he is a graduate of Annapolis, that he has had both Army and Navy experience, has been a pilot for fifteen years, has been chief Aeronautical Engineer of the Army, a member of the National Advisory Committee for Aeronautics, vice-president of the Society of Automotive Engineers, designer of the airfoils used by the Ryan, the Douglas, and some of army and navy pursuit and training planes.

The purpose of the book is to serve as an introduction to the more advanced works on aeronautical engineering. There has been a gap in the available works on the subject, particularly when the wants of the average student are considered. Not all the men interested in aviation have had the benefit of an education in higher mathematics, and engineering courses are not available to all. The strictly technical books are hardly understandable to the average man. They require a background of study and a recent acquaintance with physics and higher mathematics. It is gratifying to note that the author intends to follow this book with another that will advance the student still further into the subject, which will take up advanced problems and questions of design from a practical standpoint.

The student must take this book and follow it as a text. It cannot be read—it must be digested, for here are the mathematical principles that govern flight, expressed in understandable language. The author shows that a few fundamental principles, when understood, account for every phenomenon of flight. A sound understanding of these principles which govern design can be secured by a careful study of this work. As far as the writer is concerned, this is the first book he has seen that had a simple and easily understandable explanation of aspect ratio and the reasons therefore. Everyone who really understands aspect ratio stand up! We thought not.

Professional Pilots Association

By Waldo D. Waterman

THE Professional Pilots' Association is now entering upon its seventh year of succesful functioning. In 1921 a small group of aviators met in the office of one of the Los Angeles airports to discuss problems of aviation with particular reference to those effecting the pilots themselves. It was the desire of this group to form an association for the betterment and advancement of aviation. It was generally felt that four principal things were at that time retarding the progress of the art. These were:

1. Lack of experience or skill on the part of many pilots;
2. The use of unairworthy craft;
3. The reckless manipulation of airplanes, such as stunt flying and flying in unnecessarily low altitudes;
4. The lack of air-mindedness on the part of the public at large.

It was decided at this time to form an organization that would assist in eliminating these drawbacks and to that end the Professional Pilots' Association was organized.

The original by-laws required that all members must have flown for at least four years prior to becoming members; that they must be skilled in the art and temperamentally fit for the occupation in which they were engaged. It was further required that all members should refuse to fly craft whose airworthiness was questionable. Stunt flying and acrobatics of all sort were prohibited when carrying passengers for hire or reward.

Educational campaigns were conducted by the use of radio, personal contact and the reporting of the true causes of airplane accidents to the press.

Our first president, G. G. Budwig,

at present Chief Inspector of the Aeronautical Branch of the Department of Commerce, was one of the prime movers in the organization of the Association and the drafting of its by-laws. Since then his good work has been carried on by his successors, the following presidents: H. E. Patterson, Waldo D. Waterman, Boyd M. Shelton, E. A. Baillande, C. O. Prest.

Upon the enactment of the Air Commerce Act of 1926 many of the functions of the Professional Pilots' Association were carried to a further realization. It is interesting to note that a member of the Professional Pilots' Association, abiding by its rules, regulations and by-laws would in all respects be conducting himself as required by the air-commerce laws which were later inaugurated.

Our Association has gone further. It has established a bond of friendship and good-fellowship amongst its membership which is rapidly demolishing much of the petty jealousy and strife amongst groups of airmen where the Association functions. It has created a mutual insurance fund by which its members are enabled to get insurance at exceedingly low rates.

We point with pride to our record of the last seven years. In that period our membership has flown an aggregate of 25,000,000 miles. With the exception of one accident, which will be referred to later, no one riding in an airplane piloted by a member of the Association has ever lost his life or been seriously injured through crash, nor has any member of the Association lost his life or been injured in such a manner with the one exception. This exception was a case of one of our membership testing a new type of airplane of radical and freakish design and construction, in which the designer, his wife and son were passengers. While in a normal glide, aileron and wing flutter set in, tearing one of the wings from the plane, killing all of the passengers. We have had three other deaths in the organization. One was the sad case of Fred Hoyt, who was frozen to death in Idaho after leaving his plane with a parachute in a severe storm; our second president, Howard E. Patterson, passed away from an attack of heart failure after a year's sickness, and Kenneth Montee died of scarlet fever while on a maping exposition at the Mexican border.

Such a record for an Association with as large a membership is certainly to be envied. We at present have members all over the United States, although the largest and most active group is at Los Angeles.

The Professional Pilots' Association wishes to get in touch with every air pilot through the secretary, Palmer Nichols, 3417 Mesa Drive, Los Angeles.

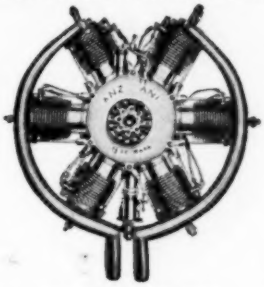
Is This a Record?

Frank Merrill, air mail pilot of the Embry-Riddle company, Lunken airport, Cincinnati, probably set a world's record during July when he flew a total of 11,682 miles carrying the mail on the Cincinnati-Indianapolis-Chicago route.

Merrill made 21 round trips on the 274 mile route, and one trip south on the morning of July 1st. He found that no pilots on any of the nine routes using the municipal field at Chicago had approached his record, and it is believed that no other pilot, or person in charge of a transportation vehicle ever traveled this far in the same space of time.

Interstate Commerce regulations limit the mileage of the locomotive engineer until he cannot total more than 4,500 miles; bus drivers are similarly limited. A passenger conductor sometimes totals 8,000 miles of travel in one month. Apparently flying an airplane, carrying passengers, mail and express does not constitute the strain that piloting a locomotive or bus does.

FOR THE SMALL PLANE



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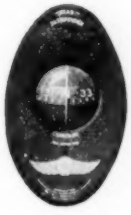

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The Salon de l'Aviation

THE eleventh Salon de l'Aviation was held in Paris at the Grand Palais from June 29th to July 15th under the management of the *Chambre Syndicale des Industries Aéronautiques*. On the opening day the Paris Air Show was visited by President Doumergue of France as well as by Messrs. Norman Armour, Counsellor of the American Embassy, Major Barton K. Yount, American Air Attaché, and R. C. Wood, Director of the Paris Chamber of the National Aeronautic Association of the United States.

America was represented this year by the Aeronautical Chamber of Commerce of America, The Fairchild Aviation Corporation and the Irving Air Chute Company. Much interest was evidenced over the exposition of the Fairchild-Caminez motor at their stand and the arrival in France of Mears and Collyer on their round the world trip with their Fairchild monoplane, the City of New York, added to the interest of the exhibit which was in charge of Captain Cyril Turner. A Wright Whirlwind motor was exhibited by the Hispano-Suiza Company, who are the exclusive agents for this motor in France. It is interesting to note that America was represented in the first Salon, that of 1909, by the exhibition of a Wright biplane.

Planes of many nations were exhibited at the Salon making it one of international importance. Exhibits by Dornier, Junkers, Heinkel, Albatross, Arado, Rohrbach, Focke Wulf, Klemm Daimler and Bayerische Flugzeuwerke gave Germany a large representation while many of her motors were at the same time exhibited. Holland was represented by the Fokker Company, Czechoslovakia by her Avia planes, which are built in Prague. A Bristol Fighter of all metal construction created much interest as an English exhibit while Belgium and Switzerland were also included in the international melée of foreign aircraft. One of the largest single exhibits was that of the *Ministere de l'Aéronautique Italienne* who exhibited several of their military and naval planes, including a huge Savoia Marchetti flying boat, as well as scale models of all types of Italian planes both for commercial and military purposes.

Among the most interesting individual planes on view at the Salon were the Bréguet "dix neuf" of Costes and Le Brix, the Macchi 52 monoplane which competed in the last Schneider Cup Race at Venice, a Junkers of the Bremen type, while several new types of commercial craft attracted attention. Two of these were designed after planes built last year for transatlantic rights. The new Farman Type B Transport plane that can accommodate twenty-five passengers was constructed after the "Oiseau Bleu" while the new Bernard monoplane was modeled after their transatlantic aspirant of a year ago.

Many types of military and naval planes were shown by the French Government to acquaint the public with their construction and means of offense and defense. Among some of these were a large C.A.M.S. flying boat of the type in which Guilbaud and Amundsen were lost in the Arctic Seas, a Schreck naval flying

boat of somewhat smaller dimensions as well as Levasseur planes of various types and sizes, some of which were equipped with devices for carrying torpedos. A large tri-motor Bleriot monoplane from which machine guns bristled in all directions and which can carry a heavy load of bombs and the framework of a huge Lioré and Olivier bombing plane with all equipment in the cabin fully assembled were of equal interest. Among some of the lighter planes for observation and pursuit duty were Morane Saulniers, Wibaults, Dewoitines, Nieuports, Bleriot Spads, Bréguets, Caudrons, Potez and others.

Probably one of the most interesting exhibits, if not the most instructive, was that in which various types of planes were shown in the process of construction and one of the galleries of the Grand Palais was arranged as a small construction works where riggers, mechanics and such were actually engaged in work on fuselages, wing assemblies and other work as was able to be demonstrated at the Salon.

Motors ranging in power from the little two cylinder 20 H.P. Mercedes and the 25 H.P. Anzani to the 1,000 H.P. Isotta Fraschini motor with many others in between were exhibited. An interesting motor was the 180 H.P. Hispano-Suiza Motor which was taken from the faithful little plane of the famous French ace, Guynemer, which he called "Vieux Charles" (Old Charles) in which he won many of his victories and which is now permanently exhibited in the Musée des Invalides.

Cuban Aeronautical Regulations

Cuba has formulated its own rules and regulations governing civil aeronautics, after refusing to ratify the International Convention for Air Navigation, according to a report from the assistant commercial attache at Havana. Some of the "high lights" of the rules and regulations are:

The President may concede the use of public lands for the purpose of air transportation by private interests.

The harbors and mouths of rivers, which on account of location and facilities, may be utilized for the landing and departure of seaplanes. The President may grant exclusive use for a specified time, and under predetermined conditions, of a specified airport to a person authorized to operate regular air services.

An airplane before being allowed to fly over national territory or waters, must be registered by the Secretary of War and Marines and must possess a written authorization as well as a certificate of security for the ship, ability of the pilot, etc. Distinguishing emblems, established by proper authorities, will be used on official aircraft and private aircraft will be marked to show nationality and registry.

Radiotelegraph and telephone apparatus may not be installed without legal authorization, which must state the use of such apparatus. Foreign aircraft flying over Cuban territory with such apparatus will be allowed to use it only in accordance with international law.

No photographic apparatus or instrument may be carried for use in an airplane, regardless of nationality, without special permission from the Secretary of War and Marines.

The government may, when deemed necessary, order the roofs of railroad stations, barracks and other public or private buildings to be painted for the guidance of pilots.

Pilots must possess the regular authorization to fly and pass periodical physical examinations, and any pilot who indulges in intoxicating liquor or drugs will take the chances of having his license revoked.

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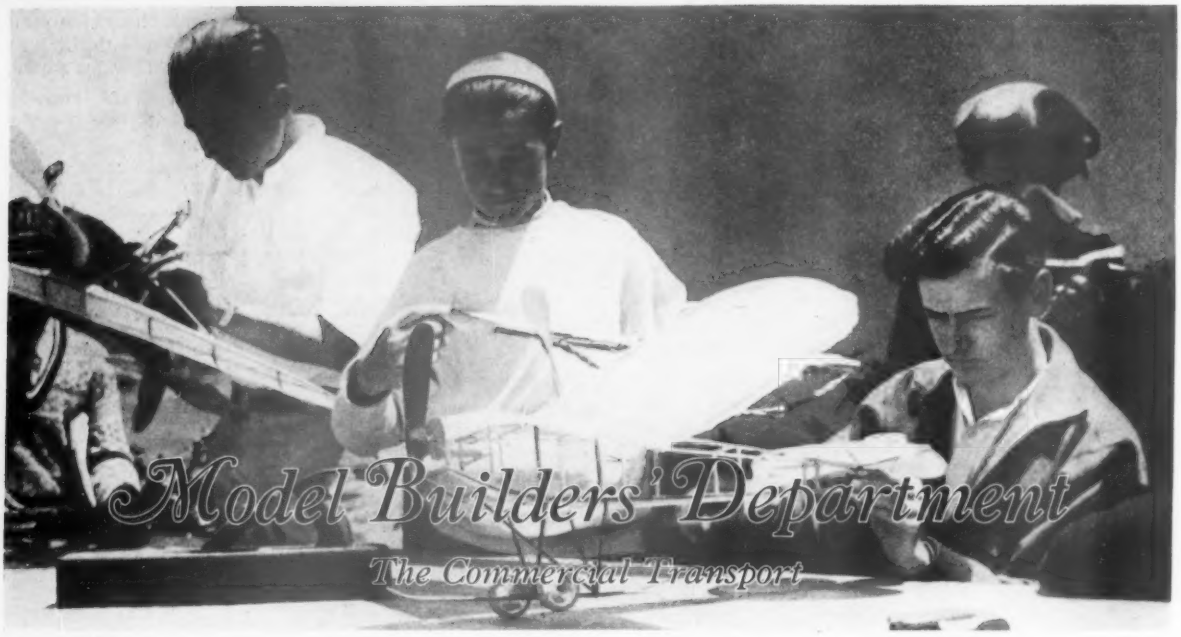


Model Builders' Department

The Commercial Transport

HERE it is—the Commercial Transport for commercial model duration and weight carrying contests! This model is designed for light weight and performance, and for contests requiring the span and length to be under 30 inches. The size of the model can be altered to suit other contest sizes.

First, let us get acquainted with the meaning of the term "commercial model." Commercial models are enclosed-fuselage models. The contest rules usually require that the rubber be entirely enclosed, in this type. A landing gear with wheels is required. Double covered wings are really an essential. "Scale models" are close reproductions of some particular large ship, and are either flying or non-flying. Flying scale models are commercial models, but commercial models are not necessarily scale models. Get this distinction clearly, for it is very important when referring to records and contests for these various models.

Points are generally given to scale models for trueness to scale, workmanship, and duration (usually 25 per cent, 25 per cent and 50 per cent respectively). Commercial models are mostly judged 100 per cent for duration after they have been checked to see if they comply with the rules.

The idea of a contest commercial model is to make the lightest duration type model possible with rubber enclosed, double cover wing, and wheel landing gear with a light arrangement for carrying weight in the proper position for the weight carrying events.

Let us see why the "Commercial Transport" is a good model for such a contest.

First, the featherweight body in which the generous size motor stick acts as one of the body longerons is the lightest arrangement possible. The arrangement provided to remove the nose and tail solves the winding problem without the weight required for the old removable motor base type or the bother of a split type bearing (for removing the propeller). The light wheels comply with the rules. Larger ones can be used for appearance, if desired.

The inverted camber elevator gives the most efficient surface yet developed for models or large planes on account of reduced drag and increased stability.

The fin in the removable tail portion of the body gives us the use of the most length of the rubber and motor base possible under the length rules, whatever they may be.

The position of the wings on the bottom prevents the heavier weight of the commercial model from pulling the wing off, as wings often do when mounted on top. The wing is fastened to the solid motor base, and not to the light body framework—good engineering, but not evident in very many commercial models! Try it out and be convinced.

If you use the new "Superfine Japanese Tissue" covering recommended, you will save considerable weight and have a neater looking model.

PARTS REQUIRED

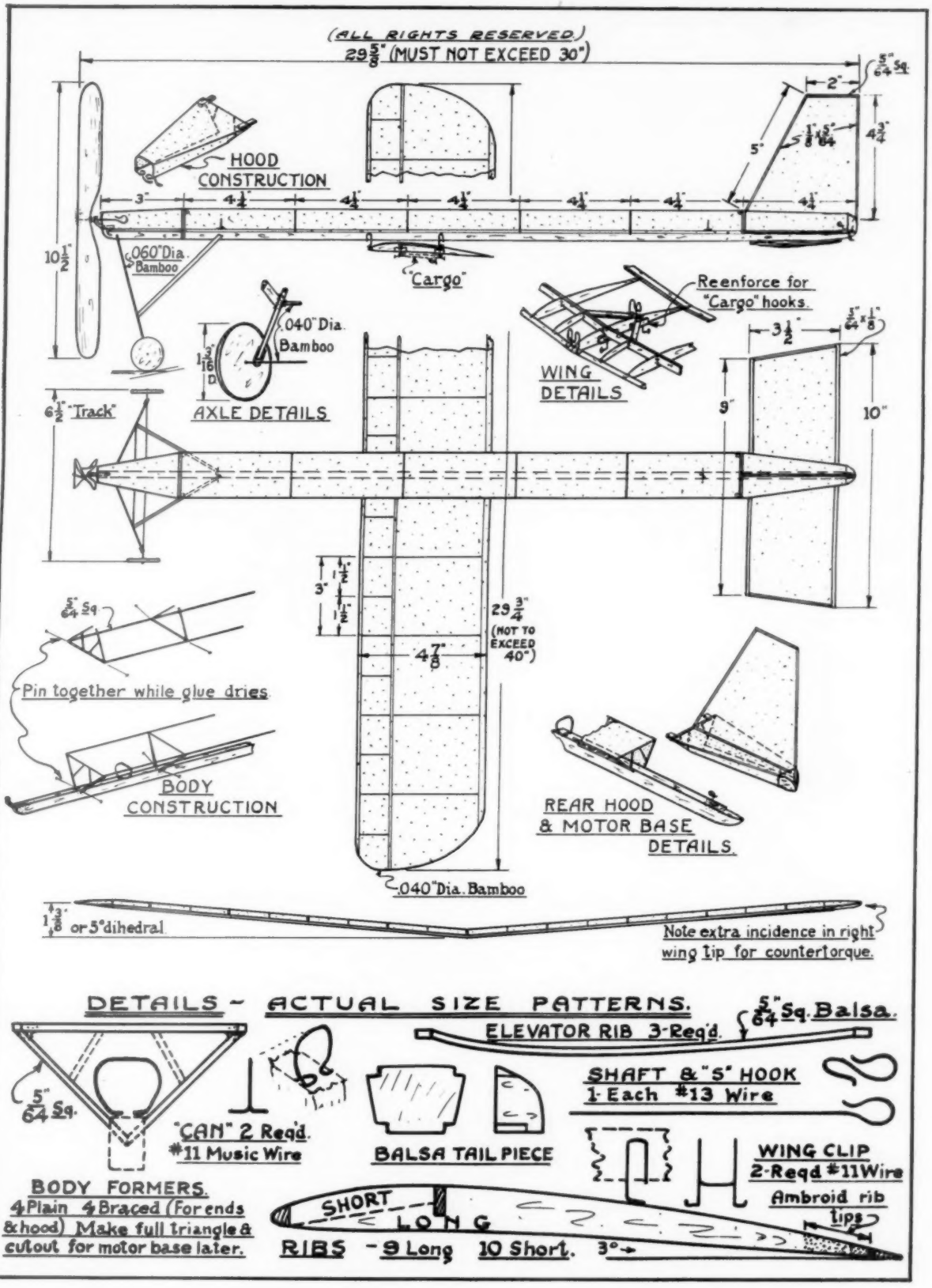
Balsa Wood Parts

4 Wing beams and trailing edges, 5/64 in. x ¼ in. x 15 in.
2 Wing entering edges, 5/32 in. x 5/32 in. x 15 in.
3 Veneer for ribs, 1/20 in. x 1 in. x 12 in.
3 Pieces round bamboo for wing tips and axle, .040 in. x 8 in.
2 Pieces round bamboo for chassis, .060 in. x 8 in.
1 Motor stick, 9/32 in. x 13/32 in. x 28½ in.
4 Pieces for body and elevator, 5/64 in. x 5/64 in. x 24 in.
1 Piece for wheels, 5/32 in. x 1¼ in. x 2½ in.
4 Pieces for elevator, fin and chassis, 5/64 in. x ⅛ in. x 12 in.
1 Propeller blank, ⅞ in. x 1¼ in. x 10½ in.
1 Tail piece, ½ in. x ⅝ in. x ⅞ in.

Miscellaneous Materials

2 Sheets new "Superfine Japanese Tissue," 18 in. x 24 in.
1 2-oz. can ambroid.
1 1-oz. bottle light cement (for paper).
1 Large bearing.
1 Rubber motor—20 feet of ⅛ in. x 1/32 in.
2 Each—Wing clips, wheel bearings and cans, or No. 11 music wire.
1 Each—Propeller shaft, hood hook, rear hook, S hook, "can," or No. 13 wire.
2 Washers.

The Commercial Transport



Bellanca "Columbia" scale model inspected by Clarence Chamberlin.

Construction

(Note: Read and study very carefully)

Propeller—The right hand propeller is carved in the usual manner to diagonal guide lines drawn across the flat faces of the ⅞ in. x 1¼ in. x 10½ in. blank. After carving is completed and the propeller sanded, round the tips and cut out the back. (It is assumed that the builder has followed the construction of former models printed in this section, so

A group of models by Paul Welshans, Wheeling, W. Va.

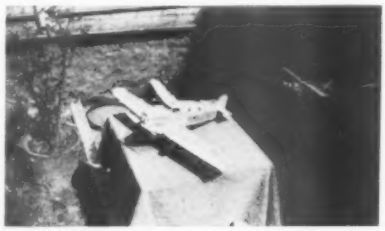
many of the similar construction details are explained only briefly here.) Then balance carefully and pierce the shaft straight through the hub. Bend it over and anchor it into the balsa. A drop of ambroid on each side will fix it in place. Two washers slipped on the shaft finish the job.

Wing—Cut all of the parts to the correct lengths. Shape the trailing edge 5/64 in. x ¼ in. x 15 in. to a wedge shape in cross section—thin at the rear and thick in front. Round off the entering edge carefully to fit smoothly into the curve of the ribs. (See actual size drawing.) Make the long and short ribs from 1/16 to 1/20 in. thick balsa veneer. Stiffen the slender tips of the long ribs by dipping them in ambroid for ½ in. Be sure the ribs are as accurate as possible. (A razor blade and a thin metal pattern makes this a quick job.) Notice that the center rib should be braced for mounting the rear wing clip with two diagonal braces, as shown in the drawing. It is re-enforced with several small balsa blocks on each side to anchor the bent pins for transporting the solder-wire cargo in the weight-carrying events.

The rear clip in the actual size drawing (side view) is shown in the correct position on the rib to get the most efficient lift from the wing—3 degrees. The tips are of .040 in. diameter bamboo bent to the shape shown. A bender such as the V. R. type makes bending bamboo a snap! It bends easily without burning. The wing tip shape shown prevents the wing from twisting badly under load.

Assemble the two halves separately on a flat table, one half left and one right hand. Accurately space the long and short ribs and taper the wing beam, and edges, at their outer tips. A silk thread trailing edge may be used to save considerable weight if you want to try a little tedious work. (If a thread is used, it should be cemented to the first side papered to form a scallop between each rib. The ribs should be made ¼ in. longer at the rear.) When the two halves have been carefully built and checked, they should be securely jointed at the center, using three coats of ambroid or even thin veneer re-enforcements on the beam and edges, as the greatest strains come at the center. Be sure to joint the halves at 5 degrees dihedral. (See edge or front view of wing alone.) Slip the re-enforced center rib in place and ambroid the diagonal wing clip braces as shown in the drawing. Make or buy wing clips as shown on the drawing, and cement them securely with several coats of ambroid. Mount the front clip on the entering edge.

A neat job of papering with the new Superfine Japanese Tissue will complete a fine, light commercial wing. (If you are tempted to dope the surfaces, buy light dope and



Welshan's model of the Junkers Bremen.

spread it crosswise with a wide brush as evenly and quickly as possible. Use a pin or suction from the lips held close to prevent the two doped surfaces from sticking together and messing up a good job otherwise.) Remember to cut the paper within ½ in. or ¾ in. of the size of the surface to be covered. Then start it straight, cementing just a little at a time. Draw the wrinkles out as you go, before the cement dries, with an outward motion of the thumbs of both hands. (See "C" model in the September issue.)

See that the right wing tip (viewed from the front) has 1/16 in. to 1/8 in. more incidence than the left side to counteract the torque of the propeller. "Wash-in" is the common term, but "counter-torque" better conveys the effect desired. Holding parts in place with common pins while ambroid is drying speeds up work considerably.

Motor Base—Cut the motor base exactly 28½ in. long. Round the front, and notch and point the rear for streamline. (See drawings.)

Four of the "C" models, described in the last issue of Popular Aviation.

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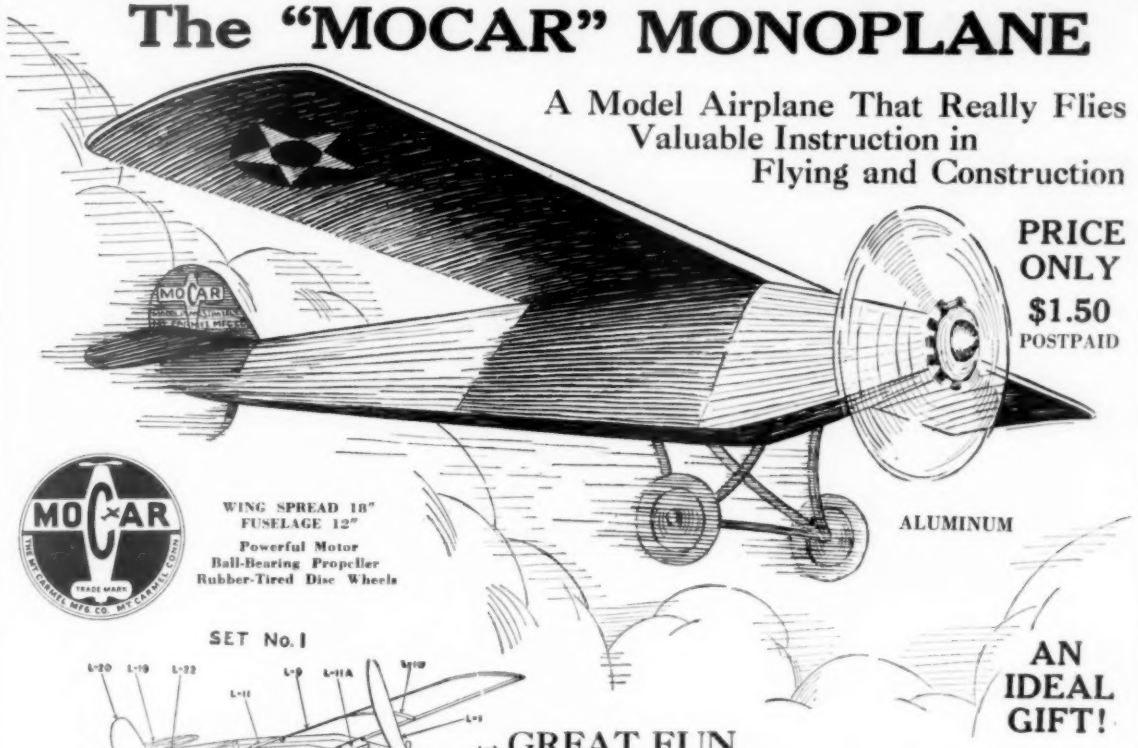

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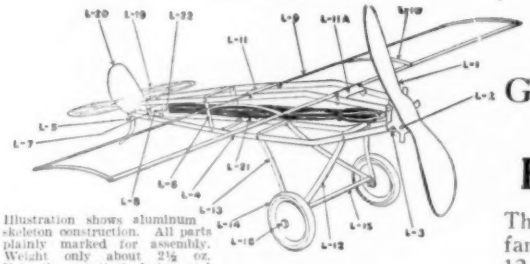

Illustration shows aluminum skeleton construction. All parts plainly marked for assembly. Weight only about 2½ oz. Note the practical design and sturdy method of building.

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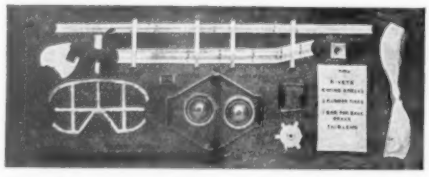

Illustration shows set mounted complete ready for assembly. Cut above shows all metal skeleton ready for covering, and the large illustration, actual cut of finished plane.

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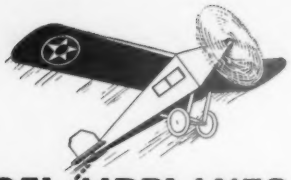

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1/16"x1/8"x3'		.03	.033
1/16"x1/4"x3'		.045	.054
1/8"x1/4"x3'		0.39	.045
1/8"x1/4"x2'		.048	.054
1/8"x1/4"x3'		.054	.06
1/4"x1/2"x3'		.099	.105
1/4"x1/2"x3'		.075	.084
1/4"x3/8"x3'		.09	.102
1/16"x 1"x3'			.24
1"x 3"x3'			.48
1"x 3"x3 1/2'			.56
1/8"x1/4"x3 1/2' Balsa I beams			.105
1/8"x1/4"x3 1/2' Balsa I beams			.123
3/16"x1/4"x3 1/2' Balsa I beams			.11
1/8"x1/8"x3 1/2' Balsa I beams			.17

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Also propellers and Wing sections.

Ambroid dope, 1/4 pint	.5
Ambroid cement, 1/8 pint	.25
Ambroid cement, 2 oz.	.33
Bamboo paper, 13"x36"	.12
Bamboo paper, 24 3/4"x33 3/4"	.14
1/8" flat rubber, 50 feet	.50
1/4" flat rubber, 50 feet	.75
1/32" Piano Wire, per coil	.15
28, 30, 32 Wire, per spool	.10
1/8" Copper Washers, 2 for	.01

Also bolts, nuts, screws, brads, etc.

Make all of the body formers—4 plain and 4 braced—as complete triangles. Cut out space for motor base after cement has dried. These 8 formers should all be exactly alike in outside sizes.

Ambroid the bearing and rear hook in place securely with three coats of ambroid. Attach the cans close to the ends of the fixed fuselage so the rubber can be fed through readily.

To assemble the fuselage easily, fasten the 5/64 in. square longerons to the body formers, properly spaced upside down by piercing with pins to hold in place while the cement dries. (See drawing.) When thoroughly dry, remove the pins and pin and cement the motor base in place in the cut out ends of the formers, making the third side of the triangular body. Remember to space the motor base correctly lengthwise, so that the removable hoods will fit correctly.

Do not paper the triangular body until after the rest of the machine is completed.

Chassis—Attach the round bamboo chassis struts to the front of the motor base as shown in the drawing, and brace with 5/64 in. x 1/8 in. balsa, and a cross piece of .040 in. round bamboo. Make wheels from 5/32 in. balsa veneer, using a fifty cent piece as a pattern. For an axle bearing, use a simple wire loop cemented to the struts. (See drawing.) A round bamboo axle shaft centered and cemented in the wheels completes the front landing gear.

For those who wish, a lighter job can be made by bending 1/2 in. of the ends of the bamboo chassis struts out horizontally and using them as axles. This eliminates the weight of the long axle shaft. Small metal washers must be cemented on each side of the wheels as bearings. A small, short wire or bamboo tail skid can be installed, but it is not essential.

Elevator—Make the simple elevator separately as one cambered unit, and cement on to the motor base with the camber down. There are only 5 pieces to this unit—the entering edge, the trailing edge, a cambered center rib, and two cambered tips. (All 3 ribs are identical.) Paper as smoothly as possible. This makes a very efficient elevator. Note: It will have a slightly negative incidence, as the rear beam should fit up against the tapered underside of the motor base.

Fin—The fin is attached to the rear removable hood. Follow the drawings and you will have no

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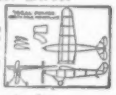

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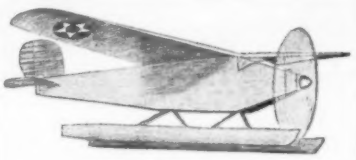

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trouble in this. Be sure that the hood fingers fit securely into the body former. Also, you must provide a removable pin to quickly anchor the rear of the hood solidly to the motor base proper when the hood is attached. Make these tail units as light as possible. Note the streamline balsa piece which acts as the rear hood tail former and fin support.

Front Hood—The front hood is very simple and made in the same manner as the rear hood. It consists of a braced body former and a special combination wire nose former and clip—the two being joined by four 5/64 in. square longeron pieces. Notice this hood is open underneath to slip over the rubber and propeller shaft. The two lower longeron pieces fit closely to the side of the motor base (at the top). Notice the two short guide fingers which locate and support the rear of the hood in position by fitting snugly into the outer corners of the body former on the motor base. Also notice that the simple wire nose former is formed to prevent the hood from slipping down too far over the motor base. It also acts as a clip to hold the front of the hood down. The use of pins to hold the hood parts together while the glue dries simplifies and speeds up the work remarkably.

Flying—String up a six, a seven, and an eight strand motor. Wind the propeller up 25 times (for glide only) and attach the hoods. The hoods should attach quickly and easily. Slip the wing on slightly to the rear of the center of the motor base. Sight the wing from the center of the front edge to make sure that the correct counter-torque is still warped into the right hand side. Give the model a trial glide by holding the motor base just to the rear of the wing and launching the model on a slightly downward angle with a gentle forward push.

If it glides evenly to the floor, your adjustment is close. If it stalls and then drops, move the wing to the rear. If it glides too steeply and noses down badly, move the wing slightly forward. When a good glide adjustment is found, wind it up a bit and take a trial flight. Make adjustments as before—and—I guess your enthusiasm by this time will cause you to take care of the rest of your adjustments.

$1.00 will be paid by the Model Editor to the person sending in the best picture of this model. Let's go!

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Index of Model Articles

You may have missed some model articles that you would like to have. Back numbers of some issues are available at 25 cents each from POPULAR AVIATION.

January, 1928

Page 50—Picture of Curtiss Hawk Model by Sergeant K. A. Woolsey.

February, 1928

Page 39—Winter Model Work. (Picture Illinois Model Aero Club scale model contest.)

Page 39—Data on a simple indoor contest glider. (Full page drawing Page 40.)

Page 41—Index to model sections previous to February.

Page 74—Corrections on several previous model and data lists.

Page 74—Drawings and descriptions of "Durable Racing Model."

Page 76—Article on Harlington Texas model plane contest.

March, 1928

Page 40—"Fairchild Cabin Monoplane," as built by Tudor Morris. Illustrated with pictures. (Drawing on page 41 shows many details in actual size, including ribs.)

Page 57—"Fairchild Model," continued.

Page 58—Model Clubs News.

Page 59—"Form a Club" (gives data on forming a club, with sample constitution).

April, 1928

Page 34—"Cook 45 Riser." Description and drawings. (Continued p. 75.)

Page 46—Description and pictures of Sergeant Woolsey's Hawk model, 1/12 scale.

May, 1928

Page 66—Photograph of Illinois Model Aero Club hydro model experts.

Page 66—Elliott Special Duration Racer. Description. (Full page drawing page 68 showing many details actual size, along with data for making hydro model). (Continued p. 87.)

June, 1928

Page 74 — Picture of Chicago Parks model builders.

Page 74—Spirit of St. Louis. A simple flying model of this famous plane described. (Drawing showing many parts actual size with construction helps, page 75.)

Page 78—Corrections on Cook Riser and Elliott models.

Page 78—Model News Items.

Page 79—Houston Model Contest.

July, 1928

Page 62—Scale Model Pointers. A group of interesting notes on the construction of light flying scale models. Illustrated with pictures.

Page 88—Model Hints (full page drawing of details of latest record models—wing clips, "cans," hollow spars, etc.).

Page 89—"Why the Longer Tail."

Page 89—"A Winder Without a Winder."

Page 90—Model Plane Book Review.

August, 1928

Page 82—Model Builders Department. Picture of contest at Municipal Pier, Chicago.

Page 82—Some of the fine points, don'ts, and hints which make ordinary models record models. Illustrated with sketches.

Page 83—Forming a Club—suggestions on how to form a club and conduct the affairs.

September, 1928

Page 82—Model Builders Departmen. Picture of Commercial Models in Los Angeles.

Page 82—The "C" Model—a description of a fine flier—a 30-in. outdoor twin pusher.

Page 83—A full page drawing of the "C" model with details actual size, making construction very simple and easy.

Page 87 — "Lost One Record Model," and how the Model Editor of POPULAR AVIATION helped the owner, Mr. Lucas, by finding it again for him. Also a discussion on Mulvihill Trophy.

Page 88—"Owes Two Cigars"—a story of the world's record indoor model which bears rereading for the moral of perseverance displayed by the builder.

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A. Roe Foyle Returns

WELL, I'm back, and glad to be, after several months of pretty hard work, working out some of the problems that are holding back aviation. Of course, I haven't had a whole lot of time to devote to it, because the shipping department is pretty busy and the boss is a little bit crabby but I have gotten in some pretty good licks. Then, too, I've had some hard luck because my friend George got laid off and for a while I did not have the services of my consulting engineer.

George, you know, is a consulting engineer and is pretty experienced in aviating, because his firm—the one he used to work for—is the Atlas Cotter Pin Company, and they make cotter pins for pretty nearly every one of the engine manufacturers. That fixes it so George has pretty good connections and is just about as good authority as one could ask for.

George has another job now, and his aviation experience will certainly stand him in good now, for he is with a steel company, and he assures me that one of their mill connections makes the same kind of tubing that they use in fuselages. He is pretty smart and sort of modest and keeps me encouraged a lot in my chosen ambition.

When I told him that I would have time to take up some of the problems again he said, "Boy, I'm glad to hear it. My evenings have been pretty dead and I can't afford a show every night."

When I asked him what would be a good thing to work on he told me that one of the troubles with airplanes was that when you had a head wind it was pretty hard to make good time, and even so noted an authority as Mr. William Bevery Hills Rogers complained bitterly about them.

"If you can figure out a really good way to overcome head winds you will certainly be Nature's Great Gift to the Industry," said George. And he said, admiringly, "I'll bet you're just the boy who can figure out a way to cheat Nature. You've been doing it for years."

Well, a hint is all I need, and I got to work. It took a lot of looking up, but I got a wonderful grounding at my ground school and I have a pretty good book on aerodynamics and I've gone through practically all of it, and I understand the first few chapters pretty well.

You see the whole thing is tied up with airfoil sections and air speeds and the propeller. Of course any one can see that if the propeller would move faster the plane would be faster, so that part is simple, all you need is a gear shift arrangement so you can run the prop in high, second or low. But that isn't all. When you study airfoil sections one of the first things that strikes you is that they are pretty thick and heavy. Of course they get them pretty light in weight so the wing isn't too heavy to fly, but in order to get them strong they have been building them a good deal too thick. I suppose that you can't get around that just yet on account of the materials you use, but what I'm surprised at is that they got them turned around.

"George," I said to my consulting engineer, "do you realize that the whole trouble can be described in four words?"

"Foyle," said George, "you can boil a thing down to pretty nearly

(*Continued on page* 113)

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Financial Survey of Aviation

(*Continued from page 29*)

are over fifty companies whose stocks are unlisted, but more or less actively traded in, which merit the attention of the searching investor. And the securities of certain of these companies have made just as satisfactory a showing as stocks on the Big Board. The present situation offers an inducement to the real student of potentialities that is not equalled in any other financial channel. This is partly explained by the fact that the period of most intensive development really began January 21, 1928, and the unusual facts connected with that development are just leaking out. Here, for example, is the National Air Transport that was just able to show any net earnings but a short while ago. It is claimed that earnings for August were around $30,000, over 200 per cent higher than the figures for the preceding month. In just one of its investments in another aeronautical company, it has, at the present market value, an item of about $750,000 profit. The depreciation charge operates heavily against transportation companies; but National Air Transport has only 30,000 shares; it has cleaned house, has effected many economies, and the recent stride in earning, accounts for $125 bid and no stock offered.

There were airplane manufacturers admitting only a few planes output six months ago, that have now reached over seventy a month with unfilled orders, requiring four to six months to fill. The following table presents quotations of some of the leading securities as of August 30th.

In the absence of any extended record of earnings, which is the case with so many aviation companies (owing to the comparative newness of the industry), perhaps the best rule would be to make a meticulous investigation of the men constituting the management.

Another rule, apparently being followed by many interested in purchasing aeronautical securities is to *diversify;* do not put all your eggs in one basket. One very successful investor made this statement: "In the aviation list, I have one good *motor* stock—one *transport*, which possesses an air mail franchise, one *airplane manufacturer* with an earning record and now paying dividends, and frankly one clean cut speculation but this company has demonstrated remarkable merchandising and business acumen."

All of the companies cannot be successful; a number must fall by the way-side, as was done in the automobile field. Over a span of years there were over 637 companies manufacturing automobiles, they now number approximately 40. New methods and inventions may render obsolete many parts of the airplane as now developed. Readjustments and reactions can be expected.

If you are inclined to invest in any aviation stock or bond—become *air-experienced*, and you will accumulate more knowledge through which to select your stocks.

In a short while, those who have never flown will be as scarce and as conspicuous as those who have never heard the radio, and they will be quite frequently referred to in private, in terms of a color that is neither red, green, or blue. Here is the answer of one man we asked for suggstions to offer one who intends to "go up" but hesitates in making a start.

"Ask the president of your bank what he considers the safest facilities in your town for the first air trip. If he does not know, or bobbles in his answer seek an approved and accredited sight-seeing company that has the sanction of the president of your chamber of commerce. If possible, get a pilot that has had an Army, Navy, or air mail training, at any rate one who has piloted over two hundred and fifty hours in the

	Bid	Ask
Aeronautical Industries, Inc.	15	18½
*Aero Supply Mfg. A	35	37
Aero Supply Mfg. B	33	35
Alexander Industries Pfd	99	100
Alexander Industries Com	3	6½
American Airports Corp.	36	47
American Neon Lights	8	11
Aviation Corp. of America	17	21
Bellanca Aircraft (1 pfd-1 com)	90	120
Cessna Aircraft Co. Pfd	100	110
Cessna Aircraft Co. Com	125	147
Claude Neon Lights, Inc.	148	160
Consolidated Instrument Co. (No Par Com)	6½	8½
*Curtis Aeroplane Co.	138	140
Curtis-Robertson (Units)	108	116
Fairchild Aviation A	44	51
Fairchild Caminez Engine Corp.	38	48
Federal Aircraft (Units) offering		100
Fokker Pfd	12	16
Fokker Com	13½	15½
Gates-Day Aircraft	12	17
Haskelite Mfg. Co. Pfd	113	119
Haskelite Mfg. Co. Com	34	39
eywood Starter	9	10
rnat'l Aircraft Pfd (par $20) offering		20
Kreider-Reisner Aircraft Pfd	98	102
Kreider-Reisner Aircraft Com	48	54
Mahoney-Ryan Aircraft Corp.	20	22
Mohawk Aircraft Co.	11	16
Mono Aircraft Pfd (par ($50)	30	37
Mono Aircraft Com (Par $10)	25	32
*Motor Meter	15½	17½
National Aero Corp. (Units) 2 Pfd—1 Com.	20	22
National Air Transport	125	...
National Aviation Corp.	28	31
Rocky Mountain Airline Com (par $10) offering		10
Scenic Airways, Inc., Pfd	7	...
Scenic Airways, Inc., Com	1½	...
Stinson Aircraft	54	60
Swallow Airplane Co.	108	119
*Thompson Products A	35½	37
*Transcontinental Air Transport	25	26
Transportation Insurance	37	48
Transportation Indemnity	20	24
Transportation Reinsurance	22	25
United States Air Transport offering	11	13
Universal Airlines (Units)	110	...
Warner Aircraft Engine	20	22
*Wright Aeronautical	177	179

*Traded on an Exchange or Curb.

air. Furthermore, be sure that he has a license entitling him to carry passengers. Know that the plane you enter has a good reputation for performance, strength, and airworthiness, and then enjoy yourself. You are a lot safer than in an automobile on any crowded thoroughfare of a large city. You will not be dizzy as there are no perspective lines joining you to the ground. You will not notice speed, but will appear to be going about ten miles an hour. If you are in a cabin plane, keep talking the same as if you were on the ground. To obviate the slight inconvenience that is noticed in the ears, swallow about every 1,000 feet up. This tends to equalize the air pressure in the ears. You will thank the person who urged you to see your city from the air. That was my experience and I am now a booster for the industry, as well as a satisfied investor."

A. Roe Foyle Returns

(*Continued from page* 111)

nothing when you get started, but I never expected you'd stop at four words. What are they?"

"Thick and turned around," I replied proudly.

"You don't mean to say you have discovered that?" said George, a look of incredulity on his face.

"Yes," I responded proudly, "the wings are too thick and are turned the wrong way."

"Oh, the wings," said George, "I thought you meant something else."

I could tell by his look of relief that something pleased him and I was on the right track, so I buckled down to work and pretty soon I had the explanation, and the remedy. It really takes diagrams to explain it but I can't make them this time as I am not going to give away the details of this idea to any one. George has often warned me about the jealousies of the different engineers and how they haven't any use for each other but will take any fellow's plans and build a whole ship out of them and only change the name, and a few little details like incidence angles and some of the ratios, and dihedrals and even then only change them a few degrees. So I am not going to give the measurements away.

You see the matter is so simple and elementary that it's a wonder it hasn't been thought of before. When you study out about drag and resistance anyone can see how foolish it is to have a big thick edge of a plane up in front, and the thin edge at the back. In a strong head wind it must be fierce the way the thick front drags in the wind and keeps you from making speed.

My idea is perfectly simple and just consists of turning the wing around. When the wind is against you the thin edge cuts through the wind just as easy and the speed will certainly be increased. It stands to reason.

Now when I mentioned this to George he thought he had me, for he said, "A lot of these wise mikes are going to tell you you're going to lose your suction, or whatever, so how will you get around that?"

Well, I could laugh at that, because I know all about this suction and lift business, and can even read the diagrams and understand what the letters in the formulae mean. This big thick edge in the back makes the air kind of skip the back end and there is such an increase in speed that there is a vacuum back of the wing. The air rushing into this vacuum pushes the plane ahead faster than ever, so there is a double benefit.

"Once in a while you will get a break," said George, "and you will have a tail wind. Have you got to stop and turn your wings around every time you have a tail wind, or will you have two planes, one for flying into the wind and one for flying with the wind?"

That's the beauty of the design, because with a tail wind this thick

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trailing edge, which is what us aviation engineers call it, will present a big surface to the wind and it will fairly blow the plane along. With the present poorly designed planes the tail winds don't help much as they strike the thin leading edge and that kind of spits the force of the wind.

"What do you think of this whole business?" I asked George.

"Boy," said George, who will insist on calling me a boy in spite of the fact that I am rather mature for my years, "I've really felt pretty selfish keeping you to myself all this time."

"Yes, but that doesn't answer my question?" I remarked, "Would it be wise to keep this to myself?"

"Let's leave the matter of wisdom out of it," answered George, "because, after all, it has nothing to do with the matter."

"Shall I let the world have those designs?" I inquired anxiously, for George showed signs of letting something get the best of him.

"Boy," said George, again calling me boy, but affectionately this time, and yet very earnestly, "I don't think the world has got any designs on you —not yet."

"Then I'll do it," I replied.

"Yes," said George, "You tell the world."

Finishing of Modern Aircraft

By R. C. Martin

Lacquer Research Dept., The Glidden Co.

This is the second part of an article by Mr. Martin on the problems of finishing aircraft. The author has made a particular study of this branch of manufacturing and is well fitted to discuss these questions.

The life of the coating on a plane is in the neighborhood of two hundred actual flying hours. At the end of this time, the fabric is ripped from the wings to determine how the unexposed parts of the craft are withstanding the elements and strain. Actual flying conditions, especially true in the air-mail service, where, in the case of a plane flying from the weather conditions of the lowlands to the high atmospheric mountain conditions, thence down to sea-level, have much to do with hastening on the breaking down of the dope. A very rigid test is therefore given on the wingspread of a plane in making such a journey, the sea-air climatic conditions probably hastening on the destruction of the dope or whatever means of a protective covering as may be applied to the wing spread and metallic surfaces, as rapidly as the sunlight and sudden weather changes.

The metallic framework of the plane is in most cases first sandblasted. This is done to roughen up the surface of the metal, so that the surface will be ready to receive coatings. Special precautions are necessary to prevent corrosion of such parts of aircraft so subjected. This is especially true of planes operating at sea. A complete lacquer schedule is recommended for metallic parts of aircraft. This schedule includes lacquer primer, lacquer surfacer and finishing lacquer enamel.

The propeller, if of wooden construction, should receive proper filling, thereby increasing the life of the protective coating and the object itself. Two or three spray coatings of spar varnish or specially constructed lacquer is applied over this filler coating. If the propeller is of metallic construction (most of the modern propellers are) it should be treated as framework parts, namely: complete lacquer schedule. A spar varnish to which is added aluminum bronze powder, may be employed. The propeller, however, should not be sandblasted, but should be sanded to roughen the surface so that it may receive coatings.

In commercial types of aircraft, the tautening effect of protective dope for the wing spread is not given as rigid a test as on government type of planes. This possibly may open a newer field for coatings, with the possibility of doubling the two hundred actual flying hour schedule required by the government before the coated fabric is ripped from the wingspread.

There is also the possible suggestion of using light weight metal panels in place of airplane cloth on this type of aircraft. The various types of commercial planes, who employ, in some cases, lacquqer enamels of automobile quality for wing spread and fuselage, have to contend a lot with blushing troubles. This condition is usually overcome by the addition to the lacquer enamel of a high grade reducer or blush retardent. This retardent, as the name implies, retards the evaporation of the lacquer, fortifying, by the slower degree of drying, the under-section of the lacquer and minimizing the absorption of moisture by the lacquer itself.

The commercial type of all-metal plane is usually finished in a two-tone lacquer color scheme. The finishing operation entails: thorough cleansing of the metal with a lacquer solvent; sanding the metal, using fine sandpaper; cleaning again with a lacquer solvent; spraying with a primer. This primer coat may be of lacquer or paint composition, reduced to a spraying consistency by the addition of the proper type of reducer. This primer may be sanded to smoothness, if it is necessary. Two continual lacquer spray color coatings are applied. These lacquer spray coatings are thoroughly dried and then sanded lightly. The surface is insured dust free and followed by two additional lacquer spray coatings of the same colors. After thoroughly dry the surface so coated may be rubbed and polished.

The metal parts of the motor housing, etc., first receives two coatings of aluminum paint of fire resistant nature. The interior is usually finished in spar varnish. The object of the lacquer enamel would be as a protective means against corrosion as well as to beautify the craft itself. Such visible colors as light green, white, light red, dark blue, gold, orange, yellow and olive green are suggested. These colors could easily be worked into two color schemes with a corresponding datto color.

The lighter-than-air type of craft, commonly called a balloon (which is a form of aircraft consisting of spherical gas bag and basket for carrying passengers), depends on the expansion or the contraction of the hollow, spherical form by the addition or the expulsion of gas for means of elevation or descension. In reality, the hollow form containing gas, being lighter than the surrounding air, arises as it is filled with gas, and is carried by the winds as it reaches the higher atmosphere. In descending, the gas is allowed to escape by mechanical means, thus rendering the craft heavier than the surrounding air and causing the craft to descend.

A rubberized fabric is used on the

inner section of spherical, captive and kite balloons and a special grade of balloon cloth is used over this rubberized fabric. A dope of the cellulose nitrate variety is employed for the protective coating, to which is added a sufficient amount of a softening medium, which renders a smooth and flexible film. This film should not shrink upon drying. This same type of nitrate dope may be used to repair the bags as they become porous. These bags are top coated with aluminum bronze powder, mixed with the clear dope. The tautening power, unlike the wingspread of heavier-than-air craft, is nonessential insofar as the rubberized fabric used inside the balloon fabric, is to be inflated with hydrogen, and as the occasion arises, may necessitate allowing this gas to escape from the bag, thereby "crinkling" the bag itself. The nitrate dope is applied in the same manner as in the case of dirigible dope; namely two brush coatings and three or four spray coatings. This dope application should not increase the weight more than five ounces per square yard.

In the finishing of such craft as dirigibles of the rigid type, which are in themselves of a more bulky nature than balloons, the method of finishing would necessarily entail a different schedule than in the finishing of heavier-than-air craft. The dirigible, with its long torpedo shape, is constructed of lightweight metal, either of duralumin or similar metals. This metallic composition comprises the frame or network of the craft. Over this frame or network there is drawn taut a durable cloth. This cloth is secured at different sections in such a way that no two sections of the cloth may meet at the same point corresponding with the run of the craft.

In the hollow section between the framework there is deposited throughout the length of the craft, vast tanks. These tanks contain gas for means of buoyancy, and are usually set in between the joints of the horizontal frames. The gas used may be hydrogen or helium variety. Because of the explosive nature of the hydrogen gas, the helium variety, controlled by the Navy Department, is used in modern government dirigibles. This gas is stored in special ground tanks and may be pumped from these tanks to the dirigible itself as occasion for use may arise. When the dirigible is not in use, the gas may be pumped into the tanks for storage, or until such time as may necessitate the inflation of the craft again for flight.

A finishing schedule for the cloth must necessarily entail one that is of as near an uninflammable nature as is possible to produce; so, to this end, a cellulose acetate dope is recommended, because of its uninflammable nature. In the event of the huge envelope taking fire while aloft, if coated with a cellulose nitrate dope, the spread of the flame would be instantaneous. This is because of the inflammability of the nitrate dope and the force of the onrushing air hastening the spread of the flame. Keeping in mind the vastness of the modern dirigible, the recommended schedule will offer quite a problem. Let us assume, for example, the craft is one thousand feet in length and one hundred twenty-five feet in diameter; in coating a craft of these dimensions, the services of a small army of men will be required and only expert work is essential.

The material used must produce the necessary tautening power and must not generate free acids, which would attack the fabric. Further, the material used must be of such a nature that with at least seven

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coatings, both clear and pigmented, the deposit must not add any unnecessary weight to the craft. The material must not raise the "nap" of the fabric, which would retard the speed of the craft in flight. Because of the bulkiness of the craft, scaffolding should necessarily be erected for the workmen in applying the dope.

The writer recommends the following schedules for a craft of this nature:

Two coats of a grade of cellulose acetate dope of the government approved variety, applied directly to the cloth by hand with a brush. Reasonable time is allotted between the coatings so as to insure proper penetration and drying of the dope. These two hand brush coats are followed by two coatings of the same material applied by means of a spray gun. The material must necessarily be reduced to this spraying consistency by the addition of a special thinner, made with the cellulose acetate solvents and dilutents. It is very essential that the reduction of the dope be very closely controlled as well as the air pressure used, and it is no easy problem when one considers that when a pressure feed type of air gun, which is the best type to use, will entail an enormous length of rubber housing.

It is further very essential that a type of spray gun be employed that will insure perfect atomization. The sprayed coating must be thoroughly a wet one, the avenue made by the operator of the spray gun must be perfect and of even strides, so as to deposit an even coating on all portions of the cloth itself. The next two coatings are of an aluminum colored nature. The clear dope is used as a basis, to which is added finely divided aluminum bronze powder, at the rate of one pound per gallon. This aluminum bronze powder adds a double protective coating to the fabric from the sunlight and weather elements, which, without the aluminum bronze powder addition, would break down the cellulose acetate coating by the generation of free acids, and so attack the fabric.

As it is very imperative that the smoothness of finish be obtained, a coating of cellulose acetate to which has been added four ounces of aluminum bronze powder per gallon of cellulose acetate dope may then be sprayed over the last two sprayed coatings, to doubly insure the smoothness of finish. The second recommended schedule is one in which a cellulose nitrate dope, of the type used in coating balloons, is recommended. Two brush coatings of a cellulose acetate dope as in the first schedule, are applied, followed by two nitrate dope (the dope made on the basis of a regular known and proven type, plus the addition of a softening medium). This operation is followed by two spray coatings of aluminum colored cellulose acetate dope, the powder content being one pound per gallon of dope. These applications are followed by cellulose acetate dope with four ounces of aluminum per gallon of base and is used as a top coat to obtain smoothness.

The writer has found that when dope is used, to which is added aluminum bronze powder for use on large areas, where a minimum deposit per square yard is essential to the lifting power and speed attained in flight, if the actual recommended amount of powder is reduced to one half that amount, lower weight will result and at the same time necessary covering power and complete protection of the inner film will result. He has also found in the conduction of tests that when an open flame came in contact with a piece of fabric coated as per the above schedule, the flame would burn through the fabric, but upon coming in contact with the free oxygen on the far side, the flame would then be extinguished. To further lessen the degree of inflammability, the writer has taken an uninflammable salt solution, on the order of antimony trichloride, and applied this solution to the fabric as a first coater. Over this salt solution, coatings of cellulose acetate and cellulose nitrate were applied and given the flame test. It was found that the degree of flammability was lower than in the case of the aforementioned schedule.

There are numerous parts of a dirigible that may be considered as a finishing problem in themselves; i. e., Duralium and light weight metal framework, gondolas, propellers, etc. These items when used in connection with aircraft, require a specially prepared product. The gondolas, of light weight construction, can also be applied to the sechedule mentioned elsewhere in this article under light-weight metals. The propellers will necessitate a specially constructed lacquer or spar varnish as a base, to which can be added aluminum. The runway throughout the length of the craft, inside the envelope and frame work, etc., will also require a special product because of climatic changes. The insignia on the craft is usually of an enamel made on a spar varnish base, but as has been mentioned elsewhere in this article, it is suggested that the colors of insignia be formulated on a cellulose acetate basis.

Duralumin and similar metals of light weight composition comprising aluminum, copper, nickel, cadmium, chromium, zinc, cobalt, tin, magnesium, etc., because of their lightness of weight, are ideal for use in aircraft construction. This type of metal, however, offers a great problem, insofar as the coating schedule is concerned. It is a known fact that some of these metals have a very pronounced attraction for moisture and when, in the case of this metal used on seaplanes, where the plane is resting on pontoons, in salty water, the attraction toward corrosion is very pronounced.

Airplanes of all-metal construction, when used on terra-firma, need not necessarily require protective covering, but with the advent of lengthy flights over seas, protection of metallic parts of aircraft is very essential to the life of the craft. It has been found that an all-metal craft need only be washed with a weak alkali every other day or so, to render it presentable when such craft is used on land. The object of applying lacquer colors would be, as mentioned, to act as protective coating and to beautify the craft. This lacquer coating is recommended for use on land and water.

In view of the fact that some of the light weight metals have a tendency toward expansion and contraction, it is suggested that the schedule for finishing be so compounded as to take care of this feature. A red oxide paint primer of long oil nature, a true nitrocellulose lacquer primer or specially constructed lacquer-varnish combination is recommended under lacquer schedule. All of these give desirable results. The priming coating should be applied very lightly to the metal.

In the automobile industry it has been found that the primer that gives the best results under lacquer schedule is one that is built on an oil basis; however, a true nitrocellulose primer, made in accordance with the behavior of the metal also gives desirable results. If the varnish-lacquer combination can be made by using a tung-oil plus additional plasticizer that has a great tolerance for cotton (in other words, the plasticizer must be a good cotton solvent), a desirable bond between the finishing medium and the primer and metal may also be secured. It must be remembered that the metal has a greater degree of expansion than

either iron or steel. All things being equal, it is evident that the type of material to use is one that has a marked degree of plasticity.

Tests are being conducted in various parts of the country, using various types of light weight metal, finished in several protective coating schedules. The object of the tests is to determine the practicability of the various used schedules on the different types of metal, in the range of climatic conditions, as well as tests in salty water to determine the degree of corrosiveness.

Pioneer Air Pilots

(*Continued from page 82*)

counters in the higher altitudes are simply beyond human endurance. But if I can stand it, and my motor works as well as it has been working, I'll come down with a record of 12,000 feet or more."

After he was in the air the wind began to increase rapidly in violence. A tent hangar was blown down, and two machines on the ground were wrecked. Hoxsey's barograph registered 7,142 feet as his highest point on the flight. He then began to descend rapidly in a series of spiral glides. Suddenly, the horrified spectators saw the plane capsize and shoot earthward at a steep angle. Evidently the wind whipped it out of control when it entered the disturbed air near the ground.

A gasp, not loud, but of tremendous volume rose from the packed grandstand. It was punctuated by the noise of the crash. The plane struck on the field; but a depression hid it from the sight of the crowd. The gathering seemed paralyzed with horror, and there was no sound until the announcer solemnly proclaimed:

"Hoxsey has been killed."

Without waiting for the further announcement that flying was suspended for the day the crowd of its own accord began to leave; many eyes were wet, and women sobbed aloud. In a short time the flags were halfmasted; the gay decorations were taken down; and a sorrowful silence reigned over the deserted expanse where he started (it might be said) and ended his career as an aviator.

Despite his unfortunate death; Hoxsey will be numbered among the great airmen of all time. He failed only where success was impossible.

Airport Planning

(*Continued from page 68*)

immense expenditure. Furthermore, with the present development of the art, flying at low altitudes over the business section of a city is hazardous and landings on a structure would be very difficult, due to the rising heat waves and the general air disturbances.

Illumination

The illumination of an airport is a problem that is far from solved. In most instances to date, merely the accepted means of illuminating large areas have been applied. These have been improved upon by the use of certain lenses giving a sharp cut-off not higher than the light source and providing an even distribution over the entire landing area. The pilot, however, is always faced with the problem of descending through the darkness and entering the lighted area at an altitude of approximately fifteen feet. With the pupils of the eyes dilated to a great extent, the pilot, due to reflection, or in some instances the direction of landing, is

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more or less blinded when coming into the light. It seems to the author that there is a great field for the development of proper airport illuminating methods, not necessarily by the application of the present-day equipment, but by beginning at the ground, and endeavoring to provide the proper type of light to illuminate the ground surface without making it necessary for the pilot at any time to face the source or to have reflections cast into his eyes from the wings or other parts of the plane. These lights must also be so designed and located that the shadow of the plane itself will not be an added interference to ground visibility.

Conclusion

In conclusion, let it be remembered that an airport is a flying field, but that a flying field is not necessarily an airport. There are many flying fields throughout the country capable of handling local planes. In other words, they have docking facilities for small craft, or for military planes, but commercial air transportation, in so far as airlines of any consequence are concerned, requires an airport with docking facilities capable of handling large air transports under all weather and field conditions. Airports must be equipped with terminal facilities for the handling of passengers, suitable hangars, shops, pilots' quarters, rest rooms, restaurants, and adequate night illumination. If flying fields are to be airports, they must have these things, all properly located.

Dodo Days

(Continued from page 56)

you every few minutes and telling one he was hopeless, dumb, and even other things, did not help me much. The psychology of teaching had not been taken into account."

I sat back after this daring assertion as I knew this was a board of defense where one could speak his mind without fear of court matrial.

The major smiled a large and, really, I believe, a sympathetic smile and read a few of the charges as to my flying.

"Do you have any further defense?" he asked.

"No, sir," and we exchanged grins.

This was a formality and its efficiency never failed. This board had a perfect batting average.

So far, I seem to be criticising somewhat the school at Brooks Field, and the system they have of training students. However, this is not the intention, since the Army Flying School at Brooks and Kelly Fields is considered one of the best, if not the best, in the world. Students receive fine training there and are qualified as real pilots upon the completion of the course.

The objection to the school is not how well they teach those who graduate but how poorly those who are eliminated are taught. There is a responsibility to each individual cadet such as the Army, due to its nature, cannot seem to feel. Perhaps it is true that the sole purpose of the Army is to maintain a strong army of defense for the country in event of an emergency, and that individuals are only considered components of that machine.

Suppose, for example, that there could be two classes of students—one the advanced and the other backward and composed of those who find it difficult to keep up the pace of those who comprehend and who are possibly more naturally adapted to learning the art or science of flying. It has often been demonstrated that the pilots who learn more slowly develop into the best pilots. It is a question of learning and doing things by training and experience so as to develop one's ability rather than selecting only those of unusual adaptability for the completion of the training. In the end this system should cost very little more if any and certainly based on the total percentage trained and the cost per person it would probably cost less. Even at that the cost is secondary to the purpose as far as the army is concerned and since peace time pursuits and commercial development are more important to the greater majority of the people then the development of commercial aviation and consequently the training of pilots for the requirements of commercial aviation is of paramount importance. In case of emergency all pilots trained could be utilized to great advantage and the government and the people protected by the army would be greatly benefited. It is a well known fact that the experiences of the past war training showed that the army used many pilots who never would get very far under the present system.

If those who do not have the same promise or qualifications as are required to finish the school, why couldn't steps be taken to give them at least 50 hours of training so that commercial aviation would be benefited and at the same time the army would have a large reserve which could be called upon in case of an emergency?

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(*Continued from page 36*)

This is done in one hour. Therefore the work per second

$$= \frac{264{,}000{,}000}{1 \times 60 \times 60}$$

$= 73{,}333$ foot pounds per second, and since 550 foot-pounds per second is one horse-power, the horse-power is

$$\frac{73{,}000}{550} = 133.3 \text{ horsepower.}$$

Energy

As used in mechanics the terms work and energy are very closely related. Energy is often defined as "the ability to do work."

If a force of ten pounds is exerted while lifting a body vertically for a distance of 15 feet off the ground the work done upon the body is $10 \times 15 =$ 150 foot pounds. (Force $\times$ distance.) The body now has potential energy of 150 foot pounds relative to the ground because on account of its elevated position it has the ability to do 150 foot pounds of work in going from the elevated position back to the ground.

If the elevated body falls it will of course lose potential energy because the force of gravity acting is always the same and the distance through which it can act is constantly becoming less.

Energy cannot be created or destroyed and in this case the potential energy which is being given up is being transformed into energy of motion or kinetic energy.

The kinetic energy of a moving body is given by the formula

$$E = \frac{WV^2}{2g}$$

where E = kinetic energy of the body in foot pounds,
W = weight of the body in pounds,
V = velocity with which the body is moving in feet per second,
g = 32.2.

An airplane weighing 2,400 pounds has a forward velocity of 45 miles per hour on landing. What is its kinetic energy upon landing and what retarding force must be applied to stop the airplane in 300 feet?

$$45 \text{ miles per hour} = \frac{45}{60} \times 88$$

$$= 66 \text{ ft./sec.}$$

$$E = \frac{2{,}400 \times (66)^2}{2 \times 32.2} = 162{,}000 \text{ ft. lbs.}$$

Work of stopping = force $\times$ distance must equal the kinetic energy.

Average force = 162,000/300 = 540 pounds.

Problems

1. A pilot wants to fly to a field due north at a distance of 200 miles. His air speed is 90 miles per hour and there is a wind from the east of 20 miles per hour. In what direction should he point his airplane to fly the shortest course? How far does he fly relative to the ground? How far does he fly relative to the air?

2. An airplane climbs 1,200 ft. per minute with an air speed of 80 miles per hour. What is the angle of climb to the horizontal if there is no wind? What is the angle of climb to the horizontal if there is a head wind of 15 miles per hour?

3. What must be the value and direction of the tail force on an airplane for horizontal flight with the resultant lift force of 2,400 pounds, ½ foot behind the center of gravity and the resultant tail force 16 feet behind the center of gravity.

4. A 4,000 pound airplane lands at 50 miles per hour on a hard dry field. What will be the length of the landing run if the retarding force averages 800 pounds?

Answers to Problems

(1) North 12½° East, 200 miles, 210 miles.
(2) 9.9°, 12.1°.
(3) 75 pounds.
(4) 415 feet.

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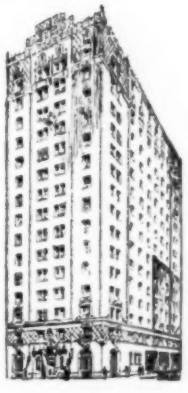

Australia Fosters Flying

(*Continued from page 32*)

are tested for the handling of the machine in spins, side-slipping, landing across the wind, and in forced landings,

This advanced course, the club contends, should be sufficient to entitle a private pilot to take friends for trips without having to do 40 hours' solo flying that is necessary at present under the rules of the department.

So far four of the club's pilots have passed the course with an "A2," or passing grade.

Under international air regulations before pilots can carry passengers for profit they must obtain the "B" license. For this it is necessary to do cross-country flying and a certain amount of night flying.

Founded originally in May, 1919, the club of which the Governor, Sir Dudley de Chair, is now patron, in 1920 became an association incorporated under the Companies Act, with the liability of its members limited by guarantee to the sum of $5.00 each in the event of liquidation. Its assets or income cannot in any circumstances be distributed or paid to its members, but can only be applied towards its objects.

This gives the organization a thoroughly independent standing, and enables it to take an impartial view of matters of importance to the progress of aviation, and to be outspoken when controversies arise.

The club was established, in the first place, to keep together the trained aviators who were returning from the Great War in 1919, and who, through the apathy of the Federal Government towards aviation at that time, seemed to about to become scattered and lose their influence in building up aviation.

Soon after the late Colonel Oswald Watt succeeded Mr. Macfie as president, the club made its presence felt under his guidance. Its first task was to play an important part in the movement to have the control of civil aviation ceded by the State to the Commonwealth, and to have the present Department of Civil Aviation formed.

In his very first speech Colonel Watt laid down that the policy of the club was to preserve the integrity of aviation. His presidency of the organization was marked by great progress, and his tragic death in 1921 at Bilgoela Beach, where his body was found washed ashore near where he had been in the habit of fishing, was a severe blow to the club.

He left $2,500 to the club and another $2,500 to provide an annual medal for the most outstanding feat of aviation in Australia every year. This has been won by F. S. Briggs, H. T. Shaw, Flight-Lieutenant I. E. M'Intyre twice, and by E. J. Jones.

A tribute to Colonel Watt's memory was the naming after him of the first Moth aeroplane to become the property of the club.

Presidents since him have been Major Barton Adams and Major T. M. Scott. Captain G. F. Hughes became president in October, 1924.

Marine Aviation in Santo Domingo

does not matter; it is quite an old church anyway.

The committee compieted their investigation at Santo Domingo City and returned to the United States on the U.S.S. Argonne in the middle of December, 1921. Most of the complaints that had been received were

(*Continued from page 28*)

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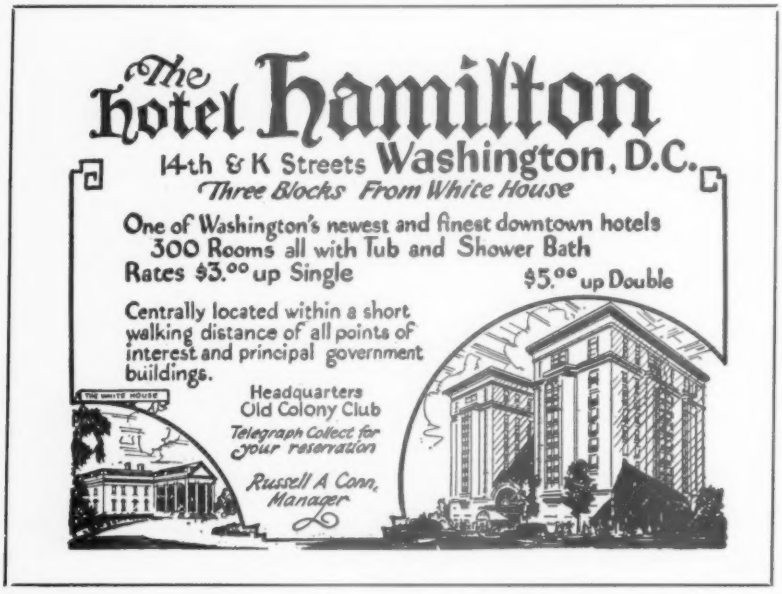
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found to be without foundation. There was evidence everywhere of the beneficial results of Marine occupation. Peace and order were apparent on all sides—and the airplane had contributed its share to the birth of a new country.

The author as officer in the Air Service, 1918, now chief pilot Stinson School of Aviation, Detriot, Mich.

(Editor's Note: In commenting on the article "Mapping Hispaniola From the Air," Mr. Hanst states that he was in Santo Domingo when Lt. Boyden crashed against the side of the mountain in a rain storm, and remembers the details of the accident distinctly. Lt. Boyden had taken a military passenger and mail to Santiago from the capital and had picked up Private Goldsmith at Santiago.

The crash was very serious and the ship was a complete washout. Lt. Boyden was critically injured and practically paralyzed, although he was lucky to escape with his life.)

An Outsider Looks at Aviation

(*Continued from page 23*)

Someone has to route the traffic, handle it, keep the accounts, and maintain the equipment. Men will be required for this work. Is an effort being made to secure them or to train them? I don't know but it seems to me that with men ready at hand, trained by the railroads, that aviation can save itself one of the hardest tasks of all business. It can find its material almost ready to use. It will not have to develop all of it.

Railroads cannot take firemen and engineers and move them into other departments and staff the whole organization with them. Aviation cannot take pilots and expect them to be the best material for every position open. It would seem to me that the very qualities that go to make the best flyer would prevent that man being a conspicuous success at the routine desk work that is so necessary in a large organization.

It is only my vital interest in aviation that has induced me to ask these questions. I look forward to seeing some of these questions answered because the answers are bound up in the success of this great development of transportation.

In the Air on the Ground

(*Continued from page 20*)

Standards in its most important experimental activities.

The altimeters used for measuring the altitude of aircraft operate on the principle of an aneroid barometer—changes in the pressure of the atmosphere deflect a flexible diaphragm which in turn moves a pointer over a graduated dial. Altimeters, although they measure the pressure of the atmosphere, are graduated in terms of altitude and on this account an arbitrary relation between altitude and pressure has been agreed upon.

The altimeter calibration standard which was used up to last year in the United States assumes that the atmosphere is at a constant temperature of 50 degrees Fahrenheit at all altitudes. This represents average conditions up to heights of about 12,000 feet accurately but above 12,000 feet, this assumption is not even approximately correct since the temperature of the air decreases rapidly with altitude. On this account, the readings of the altimeters calibrated to the old standard are very inaccurate at the high altitudes at which aircraft now fly quite frequently.

In order to remedy this difficulty, Uncle Sam held a conference of all interested national agencies and a new altimeter calibration standard was adopted by the Army Air Service, Bureau of Aeronautics of the Navy, National Advisory Committee for Aeronautics, National Aeronautical Association, Bureau of Standards and the U. S. Weather Bureau. The new standard is more in accord with average conditions of the atmosphere up to 50,000 feet than was the old one.

No other scientific agency in the world is engaged in more extensive or important research pertaining to the aeronautical industry than is the federal Bureau of Standards. A Government potentiality will be a marked increase in this line of technical investigation. With the future development of commercial aviation and the inauguration of transoceanic passenger and baggage service, many riddles of organized flying will be met, which will, of necessity, have to be solved. Uncle Sam is the skilful investigator admirably qualified for technical work of that type.

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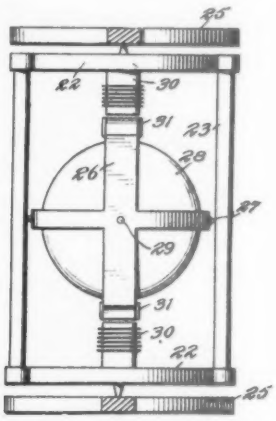
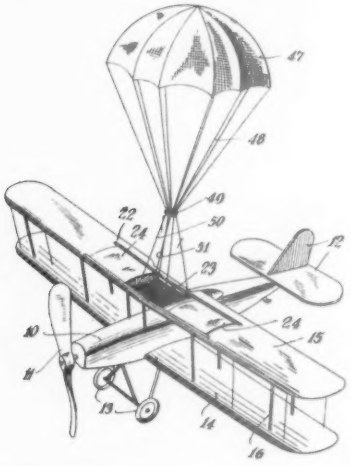
Official Patent Issues of July 17-24-31-August 7-14, 1928

No. 1,677,331, GYROSCOPIC APPARATUS, Patented July 17, 1928, by Alexander Chessin of New York, New York.



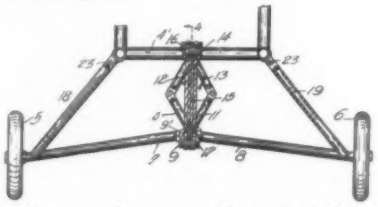
A gyroscopic apparatus particularly adapted for use in non-magnetic compasses. An important and distinctive feature of this invention is that no use is made of gravity and that the means for driving or spinning the gyroscope constitute also means for causing it to precess towards the meridian.

No. 1,677,638, SAFETY DEVICE FOR AIRPLANES, Patented July 17, 1928, by Albert Jose of Yonkers, New York.



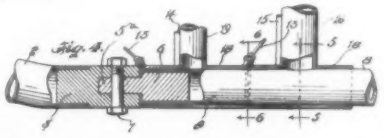
A parachute apparatus for bringing disabled aircraft safely to earth. A number of patents have been granted along this line and in some instances practical tests have been made. This particular patent discloses a parachute anchored in a concealed chamber in the upper wing, having slidable covers to permit the release of the parachute.

No. 1,677,418, LANDING GEAR, Patented July 17, 1928, by Eber Harley Van Valkenberg of McKeesport, Pennsylvania, Assignor of one-half to Oscar Silverstein of Spokane, Washington.



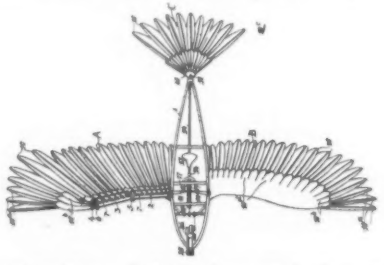
This landing gear is composed of pivoted frame members having hinged connection with the fuselage of the aeroplane and equipped with resilient cushioning means for absorbing the shocks incident to the contact of the wheels with the ground. The carriage or frame for the wheels, as a whole, is capable of assuming one form during flight and another form when landing and receiving the shock. In landing, the wheels spread apart from the normal flying position.

No. 1,677,535, FUSELAGE FOR AEROPLANES, Patented July 17, 1928, by William F. Van Cleave of Dallas, Texas, Assignor of one-half to Richard M. Barnhart of Dallas, Texas.



Detailed construction is disclosed in this patent relating to improvements in fuselages. The principal object is to provide a floating longéron in the fuselage so arranged and constructed that the longéron rods that form the principal part of the fuselage may be removed when damaged or for other reasons and new rods placed in the fuselage frame without the necessity as at present of taking down the fuselage or removing the cover therefrom.

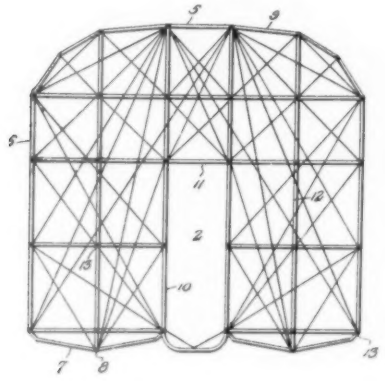
No. 1,679,356, AEROPLANE, Patented August 7, 1928, by Heinrich Grunewald of Dissen, Germany.



The construction of this aircraft is based upon as true an imitation as possible of the flight of birds. By this construction it is claimed that the required driving power is reduced to such an extent that it is possible

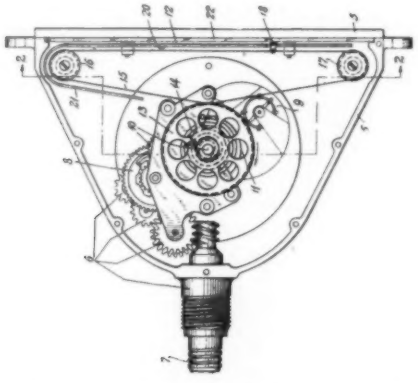
to drive the aeroplane with the aid of the human muscular strength. By the automatic adjustment of the wing feathers the air is caught during the wing stroke while with ascending wing the air is allowed to freely pass therethru due to the resiliency of the elastic wing feathers. By the air pressure the elastic feather quills are tensioned in forward direction, so that at the subsequent untensioning of the wing feathers in rearward direction the aeroplane is driven forward.

No. 1,677,962, FLYING MACHINE, Patented July 24, 1928, by Thomas M. Finley of St. Louis, Missouri. (Insert cut of Figure No. 3)



Considerable discussion is had in this patent regarding the elimination of head resistance, back-lash resistance, and vacuum resistance, ordinarily encountered in lighter than air machines. The patentee claims a body having a longitudinal channel open at the bottom and provided with a substantially funnel-shaped entrance, the walls of the entrance having receding concave inner portions arranged to form a vacuum or suck when air is drawn into the funnel-shaped entrance whereby head resistance is eliminated and a forward impulse created.

No. 1,678,009, STRAIGHT LINE INDICATING MECHANISM, Patented July 24, 1928, by Joseph Leopold of New York, New York, Assignor to Consolidated Instrument Company of America, a Corporation of New York.



The mechanism in this patent is shown as applied to a chronometric tachometer, although the claims do not limit the invention to such specific use. The object, of course, is to provide an improved mechanism suitable for instruments in which a rotary movement is measured and converted into a rectilinear movement to produce a straight line indication of the measurement.

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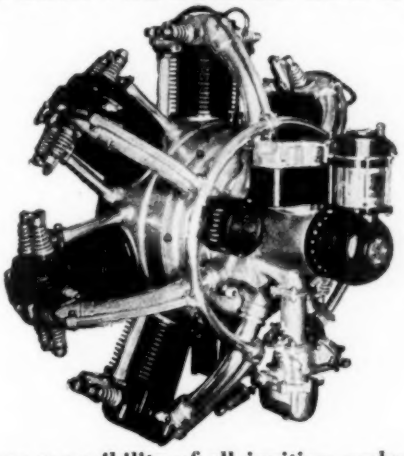

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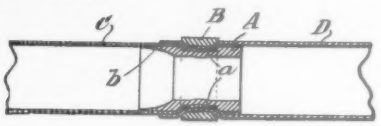
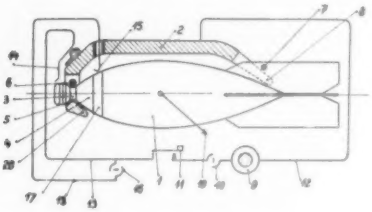
No. 1,678,640, FITTING FOR AIRCRAFT AND THE LIKE, Patented July 31, 1928, by Charles Ward Hall of Larchmont, New York.



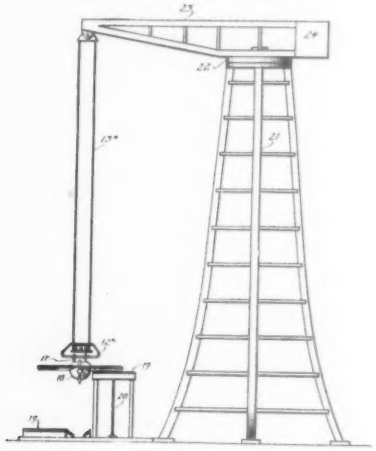
A fitting especially adaptable for use in the construction of aircraft and by which the end of a thin walled tube is joined either to the end of another similar tube or to some other structural part. Joints made in accordance with this patent are described as invariably developing the full strength of the connected tubes.

No. 1,681,007, METHOD OF DISCHARGING BOMBS AND FOR RENDERING THEIR FUSES ACTIVE, Patented August 14, 1928, by Bohdan Pantoflicek of Pilsen, Czechoslovakia.



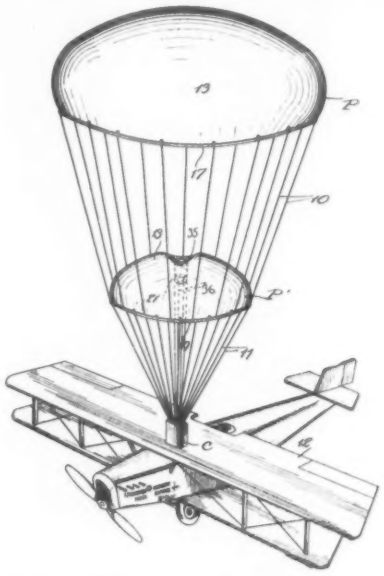
By simply switching on an electric current bombs are prepared for being discharged from aircraft and the like and, according to this patent, can then be discharged by the closing of contacts in any desired manner, either singly or in series, with or without delayed action of the fuses. The bombs or their fuses as the case may be are kept in the safety condition and are discharged or are allowed to fall by means of the electric current.

No. 1,680,473, AEROPLANE LANDING AND LAUNCHING DEVICE, Patented August 14, 1928, by Orin Parker of Bentonville, Arkansas.



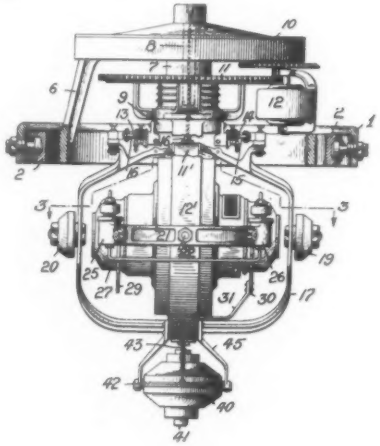
The present invention is concerned with the provision of novel mechanism primarily designed for landing and launching aeroplanes in comparatively congested areas in order that the necessity for capacious landing fields may be avoided, and the planes may be landed relatively close to the centers of large cities.

No. 1,679,242, PARACHUTE, Patented July 31, 1928, by Friedrich Wilhelm Denda of Cleveland, Ohio.



A parachute primarily designed to assist in controlling the descent of aircraft in case of accident. Means are provided for locking the parachute and projecting apparatus in a retracted position and operable for insuring a quick release of the projecting apparatus when desired.

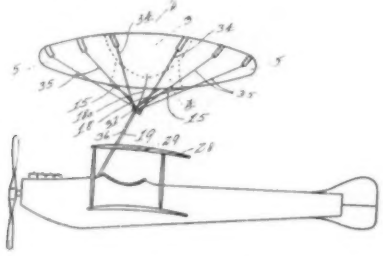
No. 1,679,438, STABILIZED GYROSCOPIC COMPASS, Patented August 7, 1928, by Chester B. Mills of Brooklyn, New York, Assignor to The Sperry Gyroscope Company of Brooklyn, New York, a Corporation of New York.



The object of this patent is to improve the operation of a compass as disclosed in a co-pending application for Letters Patent filed by this patentee, by preventing oscillation of the ring or rings supporting the gyroscope and rotor casing about the axis of the gyroscope. With all of the mercury in two tanks as shown in the prior application of this patentee, the oscillations of the system in the east-west plane may give rise to unbalanced forces due to surging of the mercury from one end of the containers to the other. By employing double the number and reducing the size of the mer-

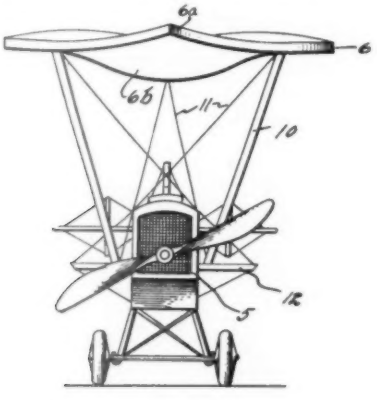
cury containers, and by placing them on opposite sides of the spinning axis of the gyroscope, this effect of the mercury is minimized. The symmetrical distribution of the containers also has the following advantages; first it reduces the overall dimensions of the compass in the N-S plane and second it greatly facilitates balancing the compass, for, since the containers are located substantially on inter-cardinal axes, they may be added, or the quantity of mercury therein varied without disturbing the balance previously made.

No. 1,679,379, STABILIZER FOR FLYING MACHINES, Patented August 7, 1928, by Ernest F. Santo of Walla Walla, Washington.



A single claim was granted in this patent, indicating that the art has been worked to quite some extent. The invention is primarily for stabilizing disabled heavier than air machines and to assist in their safe descent. A readily inflatable gas bag is provided for this purpose and one which may be deflated and again stored within the fuselange of the aeroplane, without the necessity for the aeroplane to descend. In other words, the device may be used for temporarily stabilizing an aircraft in midway for necessary repairs or adjustments.

No. 1,680,523, AEROPLANE, Patented August 14, 1928, by Orsemus L. R. Jones of Detroit, Michigan.



The protection in this patent is primarily to the wing or plane surface of aircraft. The plane is arranged with its longitudinal axis parallel with that of the body, the plane being formed with a central keel inclined upwardly from a lower central portion toward both the front and rear of the plane, and with cross ribs curving laterally from the keel to the side extremities of the plane, the cross ribs being of different lengths with the longest at the central portion of the keel.

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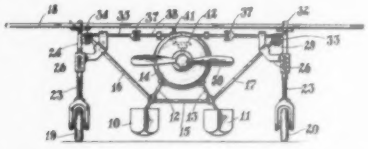
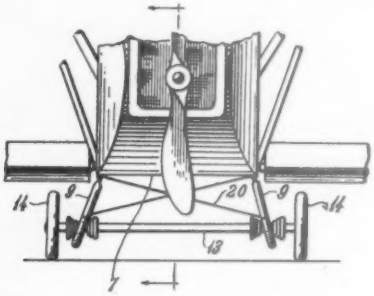
No. 1,681,071, SEA AND LAND AEROPLANE, Patented August 14, 1928, by Stephen Vitanyi of Rockaway Beach, New York.



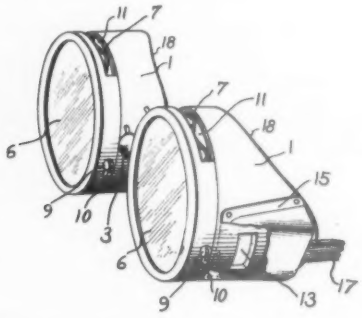
A patent drawn to protect an adjustable landing gear adapted to be readily and easily positioned so as to permit an aeroplane to alight on land or on water. The mechanism for elevating the wheels or lowering the same is operable from the motive power driving the aeroplane.

No. 1,680,511, UNDERCARRIAGE FOR AIRCRAFT, Patented August 14, 1928, by Anthony Herman Gerard Fokker of Amsterdam, Netherlands, Assignor to Atlantic Aircraft Corporation, a Corporation of New Jersey.



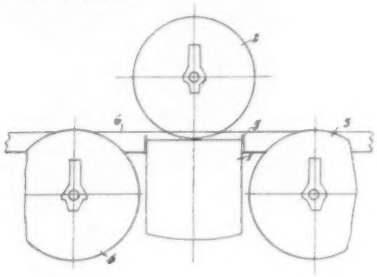
According to this patentee there has not been, up to the time of his invention, an undercarriage structure which combines lightness and strength with a range of flexibility which enables it to efficiently function not only in absorbing the impact and rebound shocks, but in taking the side loads due to making a landing, while the aeroplane is drifting sidewise. The landing apparatus is carried by an axle yieldably supported for universal movement.

No. 1,679,105, GOGGLES, Patented July 31, 1928, by George L. Tully and Solomon LaCasse of Southbridge, Massachusetts, Assignors to American Optical Company of Southbridge, Massachusetts, a voluntary association of Massachusetts.



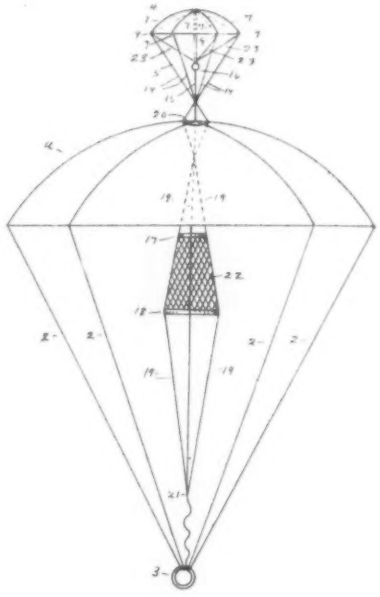
This invention provides means for holding a pair of spaced lenses with resilient means between them and with ventilating means between them in an eye cup which itself has ventilating means between the inner lens and the eye. Provision is made both for the ingress and outgress of the air on opposite sides of the eye cup both between the lenses and in the eye cup itself, and means are provided for baffling air in the larger ventilating opening into the main eye cup. This arrangement will permit of the use of colored or tinted lenses having absorption properties both of the rays of light and the glare.

No. 1,679,038, AEROPLANE WITH THREE CENTERS OF PROPULSION ARRANGED IN A TRIANGLE, Patented July 31, 1928, by Sytse Frederick Willem Koolhoven of Rijswijk, Netherlands.



This invention is illustrated only diagrammatically in the patent. According to the invention the center of propulsion interposed between the two other ones is located above the body, the propellers being arranged in such a way that in the normal flying position the area bounded by the circle of rotation of the screw or propellers is either not at all or at most 30 per cent overlapped by the vertical projection of the body. This arrangement results in that none of the propellers need operate in front of the plane of the body.

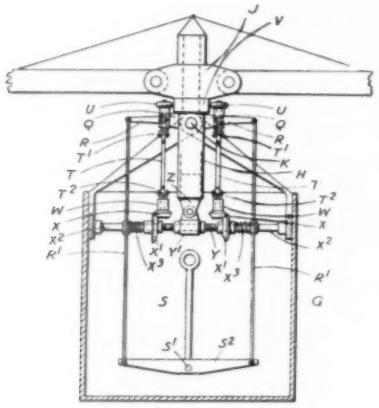
No. 1,679,714 PARACHUTE, Patented August 7, 1928, by Halvor Olsen Eiane of Detroit Harbor, Wisconsin.



The protection afforded in this patent is primarily to the construction of the auxiliary parachute or what is known as the "pilot chute." In operation, the complete parachute is packed in such way that the auxiliary parachute is packed last, the entire pack

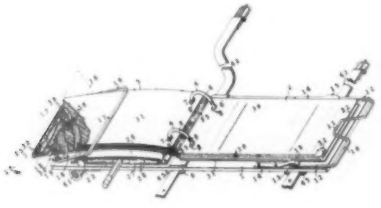
being equipped with body harness. After jumping clear from an aircraft the parachute is released by means quite different from the standard service parachute.

No. 1,678,935, AIRCRAFT WITH ROTATIVE WINGS, Patented July 31, 1928, by Juan de la Cierva of Madrid, Spain.



The structure shown in this patent is an improvement in the control of aircraft shown by the patentee's previous patent No. 1,590,497, granted to him June 29, 1926. In aircraft of this type, an automatic centering of aerodynamical pressure is obtained by the method of hingedly jointing the wings to the axis of rotation, and it has been found that, without in any way interfering with its natural stability, lateral control of the aircraft may be obtained by varying the inclination of the axis of rotation and consequently the mean plane of rotation of the wings relatively to the vertical axis of symmetry of the aircraft.

No. 1,678,981, AVIATOR'S MANIFOLDING LOG, Patented July 31, 1928, by Charles W. Giller of Shelby, Ohio, Assignor to The Shelby Salesbook Company of Shelby, Ohio, a Corporation of Ohio.



A log book in which manifolding sets of record leaves are effectively retained in designed position against chance of disturbance by strong air currents. The record leaves are retained in position for inscription and may be readily and quickly moved to and firmly held in stored position in which they do not interfere with the inscribing of subsequent sets of leaves.

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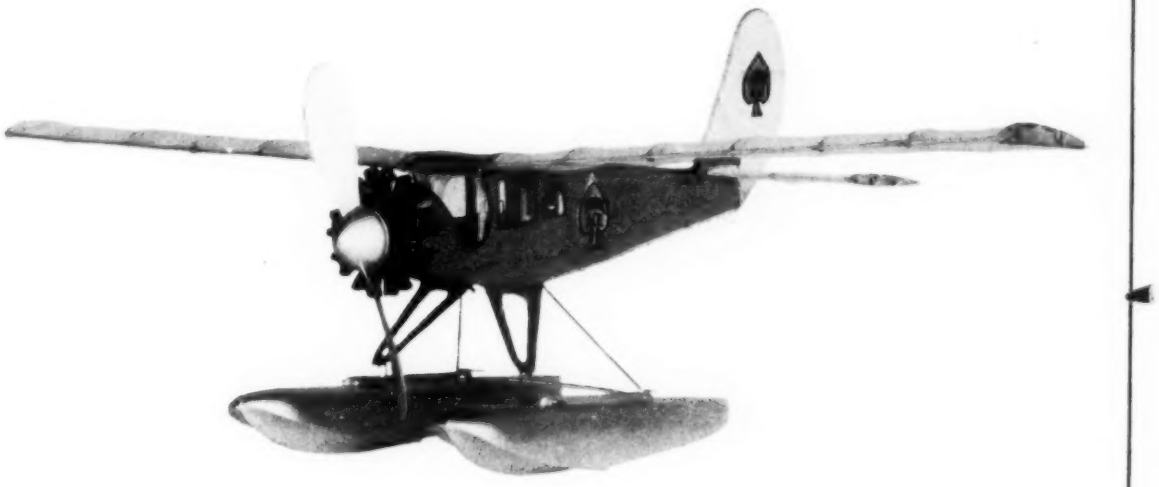

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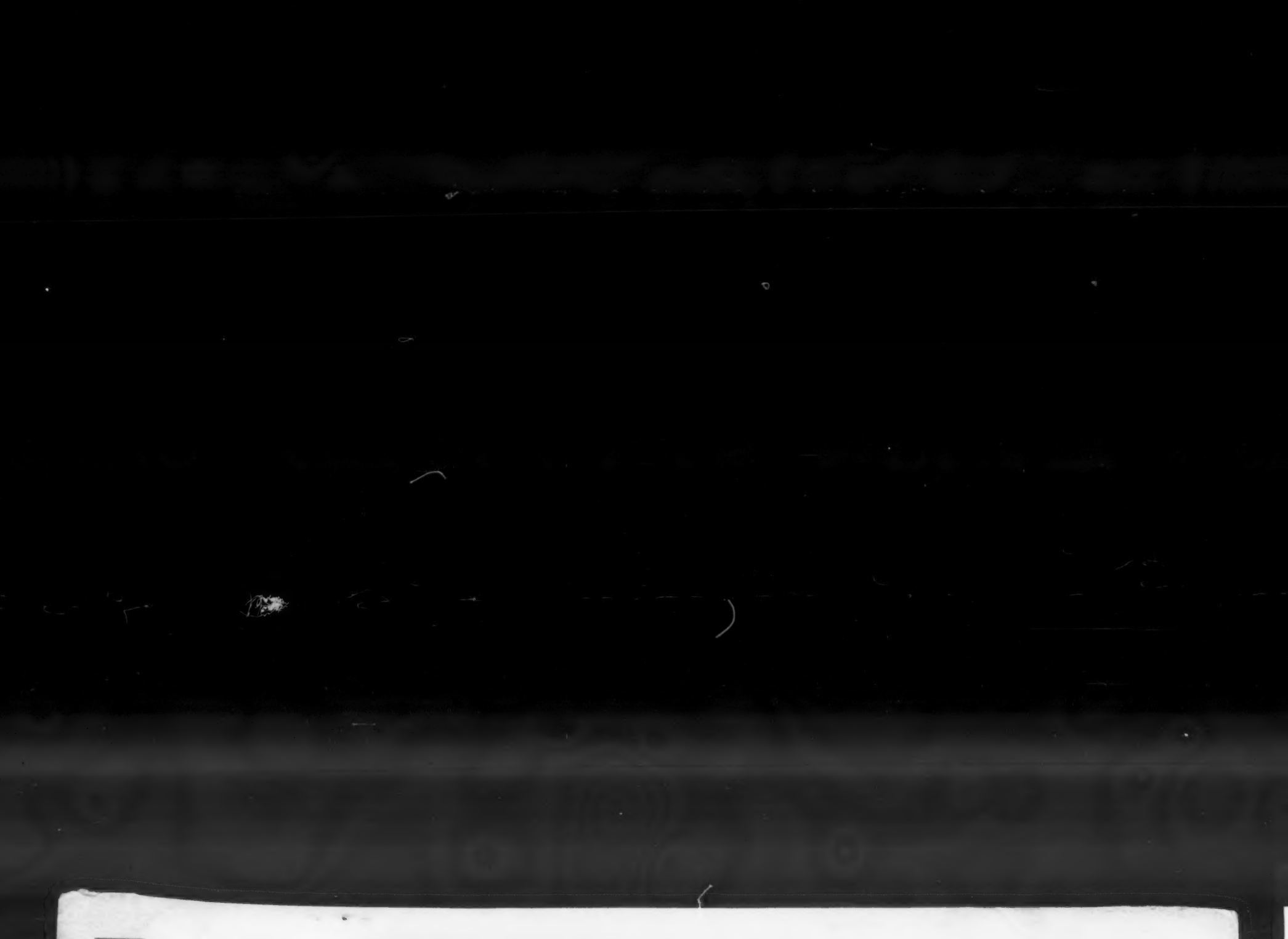
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